IBM System x3500 M4 Type 7383

Installation and User's Guide

IBM System x3500 M4 Type 7383

Installation and User's Guide

Note: Before using this information and the product it supports, read the information in Appendix B, “Notices,” on page 137, the *IBM Safety Information* and *Environmental Notices and User Guide* documents on the IBM *Documentation* CD, and the *Warranty Information* document.

The most recent version of this document is available at http://www.ibm.com/supportportal/.

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Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 Safety Information
（安全信息）。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας
(safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się
z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по
технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

Bu ürünü kurmadan önce güvenlik bilgilerini okuyun.

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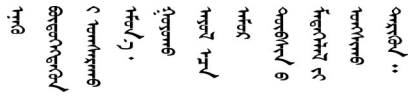


ཐོན་རྫས་འདི་བདེ་སྒྲིད་མ་བྱས་གོང་། ཁྱོད་ཀྱི་ཡིད་གཟབ་
བྱ་འདྲ་མིན་ཡོད་པའི་འདོད་སྣེར་བཤུ་དགོས།

ھەزكۇر مەھسۇلاتنى ئورنىتىشتىن بۇرۇن بىخەتەرلىك ئۇچۇرلىرىنى ئوقۇپ چىقىڭ.

Youq mwngz yungh canjbinj neix gaxgonq, itdingh aeu doeg aen canjbinj soengq cungj vahgangj ancien siusik.

Important:

Each caution and danger statement in this documentation is labeled with a number. This number is used to cross reference an English language caution or danger statement with translated versions of the caution or danger statement in the *Safety Information* document.

For example, if a caution statement is labeled "Statement 1," translations for that caution statement are in the *Safety Information* document under "Statement 1."

Be sure to read all caution and danger statements in this document before you perform the procedures. Read any additional safety information that comes with the server or optional device before you install the device.

Attention: Use No. 26 AWG or larger UL-listed or CSA certified telecommunication line cord.

Statement 1:

DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:	**To Disconnect:**
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

Statement 2:

CAUTION:
When replacing the lithium battery, use only IBM Part Number 33F8354 or an equivalent type battery recommended by the manufacturer. If your system has a module containing a lithium battery, replace it only with the same module type made by the same manufacturer. The battery contains lithium and can explode if not properly used, handled, or disposed of.

Do not:

- **Throw or immerse into water**
- **Heat to more than 100°C (212°F)**
- **Repair or disassemble**

Dispose of the battery as required by local ordinances or regulations.

Statement 3:

CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

Class 1 Laser Product
Laser Klasse 1
Laser Klass 1
Luokan 1 Laserlaite
Appareil À Laser de Classe 1

Statement 4:

≥ 18 kg (39.7 lb.)

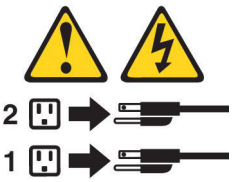
≥ 32 kg (70.5 lb.)

≥ 55 kg (121.2 lb.)

CAUTION:
Use safe practices when lifting.

Statement 5:

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Statement 6:

CAUTION:
Do not place any objects on top of a rack-mounted device unless that rack-mounted device is intended for use as a shelf.

Statement 8:

CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.

Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

Statement 11:

CAUTION:
The following label indicates sharp edges, corners, or joints nearby.

Statement 12:

CAUTION:
The following label indicates a hot surface nearby.

Statement 13:

DANGER

Overloading a branch circuit is potentially a fire hazard and a shock hazard under certain conditions. To avoid these hazards, ensure that your system electrical requirements do not exceed branch circuit protection requirements. Refer to the information that is provided with your device for electrical specifications.

Statement 15:

CAUTION:
Make sure that the rack is secured properly to avoid tipping when the server unit is extended.

Statement 17:

CAUTION:
The following label indicates moving parts nearby.

Statement 26:

CAUTION:
Do not place any object on top of rack-mounted devices.

Statement 27:

CAUTION:
Hazardous moving parts are nearby.

Statement 35:

CAUTION:
Hazardous energy present. Voltages with hazardous energy might cause heating when shorted with metal, which might result in splattered metall, burns, or both.

Attention: This server is suitable for use on an IT power distribution system whose maximum phase-to-phase voltage is 240 V under any distribution fault condition.

Chapter 1. The System x3500 M4 server

This *Installation and User's Guide* contains information and instructions for setting up your IBM System x3500 M4 Type 7383 server, instructions for installing some optional devices, and instructions for cabling, and configuring the server. For removing and installing optional devices, diagnostics and troubleshooting information, see the *Problem Determination and Service Guide* on the IBM *System x Documentation* CD, which comes with the server.

In addition to the instructions in Chapter 2, “Installing optional devices,” on page 29 for installing optional hardware devices, updating firmware and device drivers, and completing the installation, IBM Business Partners must also complete the steps in “Instructions for IBM Business Partners” on page 29.

The IBM® System x3500 M4 Type 7383 server is a 5U[1] high performance server. It can be upgraded to a symmetric multiprocessing (SMP) server through a microprocessor upgrade. It is ideally suited for networking environments that require superior microprocessor performance, efficient memory management, flexibility, and large amounts of reliable data storage.

Performance, ease of use, reliability, and expansion capabilities were key considerations in the design of the server. These design features make it possible for you to customize the system hardware to meet your needs today and provide flexible expansion capabilities for the future.

The server comes with a limited warranty. For information about the terms of the warranty, see the *Warranty Information* document that comes with the server.

The server contains IBM X-Architecture® technologies, which help increase performance and reliability. For more information, see “What your server offers” on page 8 and “Reliability, availability, and serviceability” on page 11.

You can obtain up-to-date information about the server and other IBM server products at http://www.ibm.com/systems/x/. At http://www.ibm.com/support/mysupport/, you can create a personalized support page by identifying IBM products that are of interest to you. From this personalized page, you can subscribe to weekly e-mail notifications about new technical documents, search for information and downloads, and access various administrative services.

If you participate in the IBM client reference program, you can share information about your use of technology, best practices, and innovative solutions; build a professional network; and gain visibility for your business. For more information about the IBM client reference program, see http://www.ibm.com/ibm/clientreference/.

If firmware and documentation updates are available, you can download them from the IBM website. The server might have features that are not described in the documentation that comes with the server, and the documentation might be updated occasionally to include information about those features, or technical updates might be available to provide additional information that is not included in the server documentation. To check for updates, go to http://www.ibm.com/supportportal/.

1. Racks are measured in vertical increments of 4.45 cm (1.75 inches) each. Each increment is called a "U." A 1-U-high device is 1.75 inches tall

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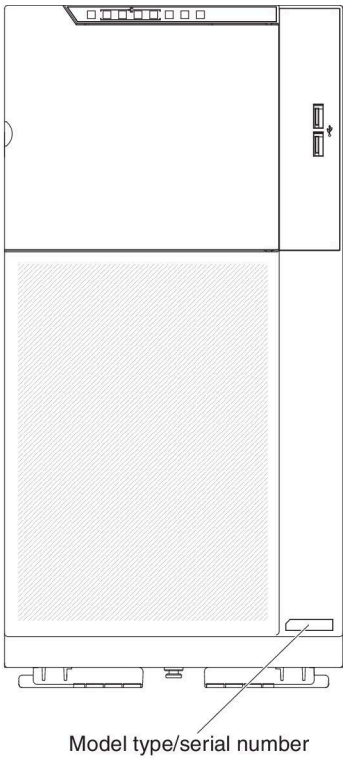
Note: The illustrations in this document might differ slightly from your model.

Record information about the server in the following table.

Product name	IBM System x3500 M4 server
Machine type	7383
Model number	_____
Serial number	_____

The model number and serial number are on the ID label on the front of the server, as shown in the following illustration.

Note: The illustrations in this document might differ slightly from your hardware.



You can download an IBM *ServerGuide Setup and Installation* CD to help you configure the hardware, install device drivers, and install the operating system.

For a list of supported optional devices for the server, see http://www.ibm.com/servers/eserver/serverproven/compat/us/.

See the *Rack Installation Instructions* document on the IBM *System x Documentation* CD for complete rack installation and removal instructions.

The IBM System x Documentation CD

The IBM *System x Documentation* CD contains documentation for the server in Portable Document Format (PDF) and includes the IBM Documentation Browser to help you find information quickly.

Hardware and software requirements

The IBM *System x Documentation* CD requires the following minimum hardware and software:

- Microsoft Windows XP, Windows 2000, or Red Hat Linux
- 100 MHz microprocessor
- 32 MB of RAM
- Adobe Acrobat Reader 3.0 (or later) or xpdf, which comes with Linux operating systems

Using the Documentation Browser

Use the Documentation Browser to browse the contents of the CD, read brief descriptions of the documents, and view documents, using Adobe Acrobat Reader or xpdf. The Documentation Browser automatically detects the regional settings in use in your server and displays the documents in the language for that region (if available). If a document is not available in the language for that region, the English-language version is displayed.

Use one of the following procedures to start the Documentation Browser:

- If Autostart is enabled, insert the CD into the CD or DVD drive. The Documentation Browser starts automatically.
- If Autostart is disabled or is not enabled for all users, use one of the following procedures:
  - If you are using a Windows operating system, insert the CD into the CD or DVD drive and click **Start -> Run**. In the **Open** field, type

    ```
    e:\win32.bat
    ```

    where *e* is the drive letter of the CD or DVD drive, and click **OK**.
  - If you are using Red Hat Linux, insert the CD into the CD or DVD drive; then, run the following command from the /mnt/cdrom directory:

    ```
    sh runlinux.sh
    ```

Select the server from the **Product** menu. The **Available Topics** list displays all the documents for the server. Some documents might be in folders. A plus sign (+) indicates each folder or document that has additional documents under it. Click the plus sign to display the additional documents.

When you select a document, a description of the document is displayed under **Topic Description**. To select more than one document, press and hold the Ctrl key while you select the documents. Click **View Book** to view the selected document or documents in Acrobat Reader or xpdf. If you selected more than one document, all the selected documents are opened in Acrobat Reader or xpdf.

To search all the documents, type a word or word string in the **Search** field and click **Search**. The documents in which the word or word string appears are listed in order of the most occurrences. Click a document to view it, and press Crtl+F to use the Acrobat search function, or press Alt+F to use the xpdf search function within the document.

Click **Help** for detailed information about using the Documentation Browser.

Related documentation

This *Installation and User's Guide* contains general information about the server including how to set up and cabling the server, how to install supported optional devices, and how to configure the server. The following documentation also comes with the server:

- *Environmental Notices and User Guide*

  This document is in PDF on the IBM *System x Documentation* CD. It contains translated environmental notices.
- *IBM License Agreement for Machine Code*

  This document is in PDF. It provides translated versions of the *IBM License Agreement for Machine Code* for your product.
- *IBM Warranty Information*

  This printed document contains the warranty terms and a pointer to the IBM Statement of Limited Warranty on the IBM website.
- *Licenses and Attributions Documents*

  This document is in PDF. It provides the open-source notices.
- *Problem Determination and Service Guide*

  This document is in PDF on the IBM *System x Documentation* CD. It contains information to help you solve problems yourself, and it contains information for service technicians.
- *Safety Information*

  This document is in PDF on the IBM *System x Documentation* CD. It contains translated caution and danger statements. Each caution and danger statement that appears in the documentation has a number that you can use to locate the corresponding statement in your language in the *Safety Information* document.

The System x and xSeries Tools Center is an online information center that contains information about tools for updating, managing, and deploying firmware, device drivers, and operating systems. The System x and BladeCenter Tools Center is at http://publib.boulder.ibm.com/infocenter/toolsctr/v1r0/index.jsp.

Depending on the server model, additional documentation might be included on the IBM *System x Documentation* CD.

The server might have features that are not described in the documentation that you received with the server. The documentation might be updated occasionally to include information about those features, or technical updates might be available to provide additional information that is not included in the server documentation. These updates are available from the IBM website. To check for updates, go to http://www.ibm.com/supportportal/.

Notices and statements in this document

The caution and danger statements in this document are also in the multilingual *Safety Information* document, which is on the IBM *System x Documentation* CD. Each statement is numbered for reference to the corresponding statement in the *Safety Information* document.

The following notices and statements are used in this document:

- **Note:** These notices provide important tips, guidance, or advice.

- **Important:** These notices provide information or advice that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate potential damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage might occur.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

Features and specifications

The following information is a summary of the features and specifications of the server. Depending on the model, some features might not be available, or some specifications might not apply.

Table 1. Features and specifications

Microprocessor:
- Support up to two Intel Xeon E5-2600 series multi-core microprocessors with integrated memory controller and Quick Path Interconnect (QPI) architecture
- Up to 2.5M Level-3 cache/core
- Two QuickPath Interconnect (QPI) links speed up to 8.0 GT per second

Note:
- Use the Setup utility program to determine the type and speed of the microprocessors.
- For a list of supported microprocessors, see http://www.ibm.com/servers/eserver/serverproven/compat/us/.

Memory:
- Slot: 12 DIMM connectors (24 DIMM connectors when the microprocessor 2 expansion board is installed)
- Minimum: 2 GB
- Maximum: 768 GB
  - 32 GB using unbuffered DIMMs (UDIMMs)
  - 384 GB using registered DIMMs (RDIMMs)
  - 768 GB using load reduction DIMMs (LRDIMMs)
- Type:
  - PC3-8500 (DDR3-1066), PC3-10600 (DDR3-1333), or PC3-12800 (DDR3-1600)
  - Single-rank, dual-rank, or quad-rank
  - Registered DIMM (RDIMM), unbuffered DIMM (UDIMM), or load reduced DIMM (LRDIMM)
- Supports (depending on the model):
  - 2 GB unbuffered DIMM (UDIMM)
  - 2 GB, 4 GB, 8 GB, and 16 GB registered DIMMs (RDIMMs)
  - 32 GB load reduction DIMM (LRDIMM)

Drives:
- SATA:
  - DVD-ROM
  - Multi-burner

  Note: Maximum of two devices can be installed
- Diskette: External USB hard disk drive
- Supported hard disk drives:
  - Serial Attached SCSI (SAS)
  - Serial ATA (SATA)

Expansion bays (depending on the model):
- Up to thirty-two 2.5-inch HDD bays
- Up to eight 3.5-inch HDD bays
- Up to two half-high 5.25-inch bays
  Note: Full-high devices such as an optional tape drive will occupy two half-high 5.25-inch bays.

PCI and PCI-X expansion slots:
- Six PCI expansion slots on the system board:
  - Slot 1: PCI Express 2.0 x8 (support optional PCI-X interposer card)
  - Slot 2: PCI Express 3.0 x8
  - Slot 3: PCI Express 3.0 x8
  - Slot 4: PCI Express 3.0 x8
  - Slot 5: PCI Express 3.0 x16 (support 225W GPU)
  - Slot 6: PCI Express 3.0 x8
- Two PCI expansion slots on the microprocessor 2 expansion board:
  - Slot 7: PCI Express 3.0 x16 (support 225W GPU)
  - Slot 8: PCI Express 3.0 x16
- PCI-X interposer card (optional):
  - One PCI-X 64-bit/133 MHz

Video controller (integrated into IMM2):
- Matrox G200eR2
  Note: The maximum video resolution is 1600 x 1200 at 75 Hz.
  - SVGA compatible video controller
  - DDR3 528 MHz SDRAM video memory controller
  - Avocent Digital Video Compression
  - 16 MB of video memory (not expandable)

Power supply:
- Up to two hot-swap power supplies for redundancy support.
  - 550-watt ac
    1. Support up to 95-watt processor.
    2. Support up to eight HDDs.
    3. GPU not supported.
    4. Support up to sixteen 1R/2R RDIMMs or UDIMMs. 4R RDIMMs and LRDIMMs are not supported.
- Up to two hot-swap power supplies for redundancy support.
  - 750-watt ac
    1. Support up to sixteen HDDs.
    2. GPU not supported.
    3. Support up to sixteen LRDIMMs, UDIMMs, or twenty-four RDIMMs.
  - 900-watt ac
    1. No GPU installed:
       a. Hard disk drive:
          - Support up to thirty-two HDDs, or,
          - Support up to sixteen HDDs if more than sixteen LRDIMMs are installed.
       b. Memory:
          - Support up to sixteen UDIMMs, or,
          - Support up to twenty-four RDIMMs/LRDIMMs, or,
          - Support up to sixteen LRDIMMs if more than sixteen HDDs are installed.
    2. One GPU installed:
       a. Hard disk drive:
          - Support up to eight HDDs.
       b. Memory:
          - Support up to sixteen LRDIMMs/UDIMMs, or,
          - Support up to twenty-four RDIMMs.

    Two 900-watt ac are required and used in non-redundant mode in the following scenarios:
    1. Two GPUs are installed.
    2. One GPU is installed and more than eight HDDs are installed.
    3. One GPU is installed and more than sixteen LRDIMMs are installed.
    4. More than sixteen HDDs are installed and more than sixteen LRDIMMs are installed.

Note: Power supplies in the server must be with the same power rating or wattage.

Table 1. Features and specifications (continued)

Simple-swap fans:
- Two (one microprocessor installed)
- Three (two microprocessors installed)
- Three additional fans (for optional redundant cooling)

Size:
- Tower
  - Height: 440 mm (17.3 in.)
  - Depth: 750 mm (29.5 in.)
  - Width: 218 mm (8.6 in.)
  - Weight: approximately 39.8 kg (87.7 lb) when fully configured or 25.0 kg (55.1 lb) minimum
- Rack
  - 5 U
  - Height: 218 mm (8.6 in.)
  - Depth: 702 mm (27.6 in.)
  - Width: 424 mm (16.7 in.)
  - Weight: approximately 39.3 kg (86.6 lb) when fully configured or 24.5 kg (54.0 lb) minimum

Racks are marked in vertical increments of 4.45 cm (1.75 inches). Each increment is referred to as a unit, or "U." A 1-U-high device is 4.45 cm (1.75 inches) tall.

Integrated functions:
- Integrated Management Module II (IMM2), which consolidates multiple management functions in a single chip.
- Intel I350AM4 Quad Port Gigabit Ethernet controller with Wake on LAN support
- Serial over LAN (SOL) and serial redirection over Telnet or Secure Shell (SSH)
- One systems-management 1 Gb Ethernet port for connection to a dedicated systems-management network. This system management connector is dedicated to the IMM2 functions.
- Light path diagnostics
- Six Universal Serial Bus (USB) ports standard
  - Two on front of server
  - Four on rear of server
- One internal USB port for optional USB flash device with embedded hypervisor
- One internal USB tape connector
- One serial connector

RAID controllers (depending on the model):
- A ServeRAID M1115 SAS/SATA adapter that provides RAID 0, 1, and 10 with optional FoD RAID 5/50 and SED (Self Encrypting Drive) upgrade.
- A ServeRAID M5110 SAS/SATA adapter that provides RAID 0, 1, and 10.
  Optional upgrade:
  - RAID 5/50 (512 MB Cache) with optional FoD RAID 6/60 and SED upgrade
  - RAID 5/50 (512 MB Flash) with optional FoD RAID 6/60 and SED upgrade
  - RAID 5/50 (1 GB Flash) with optional FoD RAID 6/60 and SED upgrade
  - RAID 5/50 and SED (Zero Cache)

Acoustical noise emissions:
- Sound power, idling: 6.0 bels
- Sound power, operating: 6.0 bels

Environment:
- Air temperature:
  - Server on: 10°C to 35°C (50.0°F to 95.0°F); altitude: 0 to 914.4 m (3000 ft)
  - Server on: 10°C to 32°C (50.0°F to 89.6°F); altitude: 914.4 m (3000 ft) to 2133.6 m (7000 ft)
  - Server off (with standby power): 10°C to 43°C (50.0°F to 109.4°F); maximum altitude: 2133.6 m (7000 ft)
  - Shipment: -40°C to 60°C (-40°F to 140°F)
- Humidity:
  - Server on: 8% to 80%; maximum dew point 21°C; maximum rate of change: 5°C/hour
  - Server off (with standby power): 8% to 80%; maximum dew point: 27°C
- Particulate contamination:

  Attention: Airborne particulates and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the server. For information about the limits for particulates and gases, see "Particulate contamination" on page 139.

Heat output:

Approximate heat output:
- Minimum configuration: 2013 Btu per hour (590 watts)
- Maximum configuration: 3610 Btu per hour (1058 watts)

Electrical input:
- Sine-wave input (50 - 60 Hz) required
- Input voltage low range:
  - Minimum: 100 V ac
  - Maximum: 127 V ac
- Input voltage high range:
  - Minimum: 200 V ac
  - Maximum: 240 V ac
- Input kilovolt-amperes (kVA), approximately:
  - Minimum: 0.60 kVA
  - Maximum: 1.10 kVA

Notes:
1. Power consumption and heat output vary depending on the number and type of optional features installed and the power-management optional features in use.
2. The noise emission level stated is the declared (upper limit) sound power level, in bels, for a random sample of machines. All measurements are made in accordance with ISO 7779 and reported in conformance with ISO 9296.

What your server offers

The server uses the following features and technologies:

- **Features on Demand**

  If a Features on Demand feature is integrated in the server or in an optional device that is installed in the server, you can purchase an activation key to activate the feature. For information about Features on Demand, see http://www.ibm.com/systems/x/fod/.

- **Integrated Management Module II**

  The integrated management module II (IMM2) is the second generation of the IMM. The IMM2 is the common management controller for IBM System x hardware. The IMM2 consolidates multiple management functions in a single chip on the server system board.

  Some of the features that are unique to the IMM2 are enhanced performance, expanded compatibility with blade servers, higher-resolution remote video, expanded security options, and Feature on Demand enablement for hardware and firmware options.

  For additional information, see “Using the Integrated Management Module II” on page 126.

- **UEFI-compliant server firmware**

  IBM System x Server Firmware (server firmware) offers several features, including Unified Extensible Firmware Interface (UEFI) 2.1 compliance; Active Energy Manager technology; enhanced reliability, availability, and serviceability (RAS) capabilities; and basic input/output system (BIOS) compatibility support. UEFI replaces the BIOS and defines a standard interface between the operating system, platform firmware, and external devices. UEFI-compliant System x servers are capable of booting UEFI-compliant operating systems, BIOS-based operating systems, and BIOS-based adapters as well as UEFI-compliant adapters.

  Note: The server does not support DOS (Disk Operating System).

- **IBM Dynamic System Analysis Preboot diagnostics programs**

  The Dynamic System Analysis (DSA) Preboot diagnostics programs are stored on the integrated USB memory. It collects and analyzes system information to aid in diagnosing server problems. The diagnostic programs collect the following information about the server:

  – System configuration
  – Network interfaces and settings
  – Installed hardware
  – Light path diagnostics status
  – Service processor status and configuration
  – Vital product data, firmware, and UEFI (formerly BIOS) configuration
  – Hard disk drive health
  – RAID controller configuration
  – Event logs for ServeRAID controllers and service processors

  The diagnostic programs create a merged log that includes events from all collected logs. The information is collected into a file that you can send to IBM service and support. Additionally, you can view the information locally through a generated text report file. You can also copy the log to a removable media and view the log from a web browser.

For additional information about DSA Preboot diagnostics, see the *Problem Determination and Service Guide* on the IBM *System x Documentation* CD

- **Multi-core processing**

  The server supports up to two Intel Xeon™ E5-2600 series multi-core microprocessors. The server comes with only one microprocessor installed.

- **IBM Systems Director**

  IBM Systems Director is a workgroup-hardware-management tool that you can use to centrally manage System x and xSeries servers. For more information, see the IBM Systems Director Information Center at http://publib.boulder.ibm.com/infocenter/director/v6r1x/index.jsp?topic=/director_6.1/fqm0_main.html and "IBM Systems Director" on page 12.

- **IBM X-Architecture technology**

  IBM X-Architecture technology combines proven, innovative IBM designs to make your Intel-processor-based server powerful, scalable, and reliable. For more information, see http://www.ibm.com/servers/eserver/xseries/xarchitecture/enterprise/index.html.

  – **Active™ Memory**

    The Active Memory feature improves the reliability of memory through memory mirrored channel. Memory mirrored channel mode replicates and stores data on two pairs of DIMMs within two channels simultaneously. If a failure occurs, the memory controller switches from the primary pair of memory DIMMs to the backup pair of DIMMs. For more information about installing DIMMs for memory mirrored channel, see "Installing a memory module" on page 77.

  – **Large system-memory capacity**

    The memory bus supports up to 384 GB of system memory when registered DIMMs are installed. The server supports up to 64 GB if unbuffered DIMMs are installed. The memory controller supports error correcting code (ECC) for up to 24 industry-standard PC3-8500 (DDR3-1066), PC3-10600 (DDR3-1333), or PC3-12800 (DDR3-1600), DDR3 (third-generation double-data-rate), synchronous dynamic random access memory (SDRAM) dual inline memory modules (DIMMs).

- **IBM *ServerGuide Setup and Installation* CD**

  The *ServerGuide Setup and Installation* CD, which you can download from the web, provides programs to help you set up the server and install a Windows operating system. The ServerGuide program detects installed optional hardware devices and provides the correct configuration programs and device drivers. For more information about the *ServerGuide Setup and Installation* CD, see "Using the ServerGuide Setup and Installation CD" on page 118.

- **Integrated network support**

  The server comes with an integrated dual-port Intel Gigabit Ethernet controller, which supports connection to a 10 Mbps, 100 Mbps, or 1000 Mbps network. For more information, see “Configuring the Ethernet controller” on page 130.
- **Integrated Trusted Platform Module (TPM)**

  This integrated security chip performs cryptographic functions and stores private and public secure keys. It provides the hardware support for the Trusted Computing Group (TCG) specification. You can download the software to support the TCG specification, when the software is available. See http://www.ibm.com/servers/eserver/xseries/scalable_family.html for details about the TPM implementation. You can enable TPM support through the Setup utility under the **System Security** menu option.
- **Large data-storage capacity and hot-swap capability**

  The hot-swap server models support a maximum of thirty-two 2.5-inch or eight 3.5-inch hot-swap Serial Attached SCSI (SAS) hard disk drives or hot-swap Serial ATA (SATA) hard disk drives. The simple-swap server models support a maximum of eight 3.5-inch simple-swap SATA hard disk drives.

  With the hot-swap feature, you can add, remove, or replace hard disk drives without turning off the server.
- **Light path diagnostics**

  Light path diagnostics provides LEDs to help you diagnose problems. For more information about the light path diagnostics, see “Light path diagnostics panel” on page 16 and the *Problem Determination and Service Guide* on the IBM *System x Documentation* CD.
- **PCI adapter capabilities**

  The server has six PCI interface slots. Slot 1 can support PCI Express or PCI-X adapters through an optional PCI-X interposer card. See “Installing an adapter” on page 86 for detailed information.
- **Active Energy Manager**

  The IBM Active Energy Manager solution is an IBM Systems Director plug-in that measures and reports server power consumption as it occurs. This enables you to monitor power consumption in correlation to specific software application programs and hardware configurations. You can obtain the measurement values through the systems-management interface and view them, using IBM Systems Director. For more information, including the required levels of IBM Systems Director and Active Energy Manager, see the IBM Systems Director Information Center at http://publib.boulder.ibm.com/infocenter/director/v6r1x/index.jsp?topic=/director_6.1/fqm0_main.html, or see http://www.ibm.com/servers/systems/management/director/resources/.
- **Redundant connection**

  The addition of the optional Ethernet daughter card provides failover capability to a redundant Ethernet connection with the applicable application installed. If a problem occurs with the primary Ethernet connection and the optional Ethernet daughter card is installed on the server, all Ethernet traffic that is associated with the primary connection is automatically switched to the optional redundant Ethernet daughter card connection. If the applicable device drivers are installed, this switching occurs without data loss and without user intervention.
- **Redundant cooling and optional power capabilities**

  The server supports a maximum of two 750-watt or 900-watt hot-swap power supplies and six simple-swap fans, which provide redundancy and hot-swap capability for a typical configuration. The redundant cooling by the fans in the

server enables continued operation if one of the fans fails. The server comes with one 750-watt or 900-watt hot-swap power supply and two fans.

You must install fan 2 when you install the second microprocessor in the server. You can order the optional fan 4, 5, and 6 for cooling redundancy. You can order the second optional power supply for power redundancy.

Notes:

1. You cannot mix 750-watt and 900-watt power supplies in the server.
2. The server is not running in power redundant mode with two 225W GPUs installed, two 900-watt power supplies are required.

- **ServeRAID support**

  The ServeRAID adapter provides hardware redundant array of independent disks (RAID) support to create configurations. The standard RAID adapter provides RAID levels 0, 1, and 10. An optional RAID adapter is available for purchase.

- **Systems-management capabilities**

  The server comes with an integrated management module II (IMM2). When the IMM2 is used with the systems-management software that comes with the server, you can manage the functions of the server locally and remotely. The IMM2 also provides system monitoring, event recording, and network alert capability. The system-management connector on the rear of the server is dedicated to the IMM2. The dedicated system-management connector provides additional security by physically separating the management network traffic from the production network. You can use the Setup utility to configure the server to use a dedicated systems-management network or a shared network.

Reliability, availability, and serviceability

Three important computer design features are reliability, availability, and serviceability (RAS). The RAS features help to ensure the integrity of the data that is stored in the server, the availability of the server when you need it, and the ease with which you can diagnose and correct problems.

Your server has the following RAS features:

- 3-year parts and 3-year labor limited warranty for machine type 7383
- Automatic error retry and recovery
- Automatic restart on nonmaskable interrupt (NMI)
- Automatic restart after a power failure
- Backup basic input/output system switching under the control of the Integrated Management Module II (IMM2)
- Built-in monitoring for fan, power, temperature, voltage, and power-supply redundancy
- Chipkill memory protection
- Diagnostic support for ServeRAID and Ethernet adapters
- Error correcting code (ECC) L2 cache and system memory
- Simple-swap cooling fans with speed-sensing capability
- Hot-swap hard disk drives
- Information and light path diagnostics LED panels
- Integrated Management Module II (IMM2)
- Menu-driven setup, system configuration, and redundant array of independent disks (RAID) configuration programs
- Microprocessor built-in self-test (BIST), internal error signal monitoring, configuration checking, and microprocessor and voltage regulator module failure identification through light path diagnostics
- Memory mirrored channel support (memory mirrored channel are mutually exclusive of each other)

- Parity checking on the small computer system interface (SCSI) bus and PCI buses
- Power management: Compliance with Advanced Configuration and Power Interface (ACPI)
- Power-on self-test (POST)
- Predictive Failure Analysis (PFA) alerts on memory, SAS/SATA hard disk drives, fans, and power supplies
- Redundant Ethernet capabilities with failover support
- Redundant hot-swap power supplies and redundant simple-swap fans
- Redundant Network Interface Card (NIC) support
- Remind button to temporarily turn on the system-error LED
- Remote system problem-determination support
- ROM-based diagnostics
- ROM checksums
- Serial Presence Detection (SPD) on memory, VPD, power supply, and hard disk drives backplane
- DIMM isolation of excessive correctable error or multi-bit error by the Unified Extensible Firmware Interface (UEFI)
- Standby voltage for system-management features and monitoring
- Startup (boot) from LAN through remote initial program load (RIPL) or dynamic host configuration protocol/boot protocol (DHCP/BOOTP)
- System auto-configuring from the configuration menu
- System-error logging (POST and IMM2)
- Systems-management monitoring through the Inter-Integrated Circuit (IC) protocol bus
- Upgradeable POST, Unified Extensible Firmware Interface (UEFI), diagnostics, IMM2 firmware, and read-only memory (ROM) resident code, locally or over the LAN
- Vital product data (VPD) on microprocessors, system board, power supplies, and SAS/SATA (hot-swap hard disk drive) backplane
- Wake on LAN capability

IBM Systems Director

IBM Systems Director is a platform-management foundation that streamlines the way you manage physical and virtual systems supports multiple operating systems and virtualization technologies in IBM and non-IBM x86 platforms.

Through a single user interface, IBM Systems Director provides consistent views for viewing managed systems, determining how these systems relate to one other, and identifying their statuses, helping to correlate technical resources with business needs. A set of common tasks that are included with IBM Systems Director provides many of the core capabilities that are required for basic management, which means instant out-of-the-box business value. The common tasks include the following:

- Discovery
- Inventory
- Configuration
- System health
- Monitoring
- Updates
- Event notification
- Automation for managed systems

The IBM Systems Director web and command-line interfaces provide a consistent interface that is focused on driving these common tasks and capabilities:

- Discovering, navigating, and visualizing systems on the network with the detailed inventory and relationships to the other network resources
- Notifying users of problems that occur on systems and the ability to isolate the sources of the problems
- Notifying users when systems need updates and distributing and installing updates on a schedule
- Analyzing real-time data for systems and setting critical thresholds that notify the administrator of emerging problems
- Configuring settings of a single system and creating a configuration plan that can apply those settings to multiple systems
- Updating installed plug-ins to add new features and functions to the base capabilities
- Managing the life cycles of virtual resources

For more information about IBM Systems Director, see the IBM Systems Director Information Center at http://publib.boulder.ibm.com/infocenter/director/v6r1x/index.jsp?topic=/director_6.1/fqm0_main.html and the Systems Management web page at http://www.ibm.com/systems/management/, which presents an overview of IBM Systems Management and IBM Systems Director.

The Update*Xpress* System Packs

The Update*Xpress* System Pack Installer detects supported and installed device drivers and firmware in the server and installs available updates. For additional information and to download the Update*Xpress* System Pack Installer, go to the ToolsCenter for System x and BladeCenter at, go to http://www.ibm.com/systems/support/supportsite.wss/docdisplay?lndocid=SERV-XPRESS&brandind=5000008.

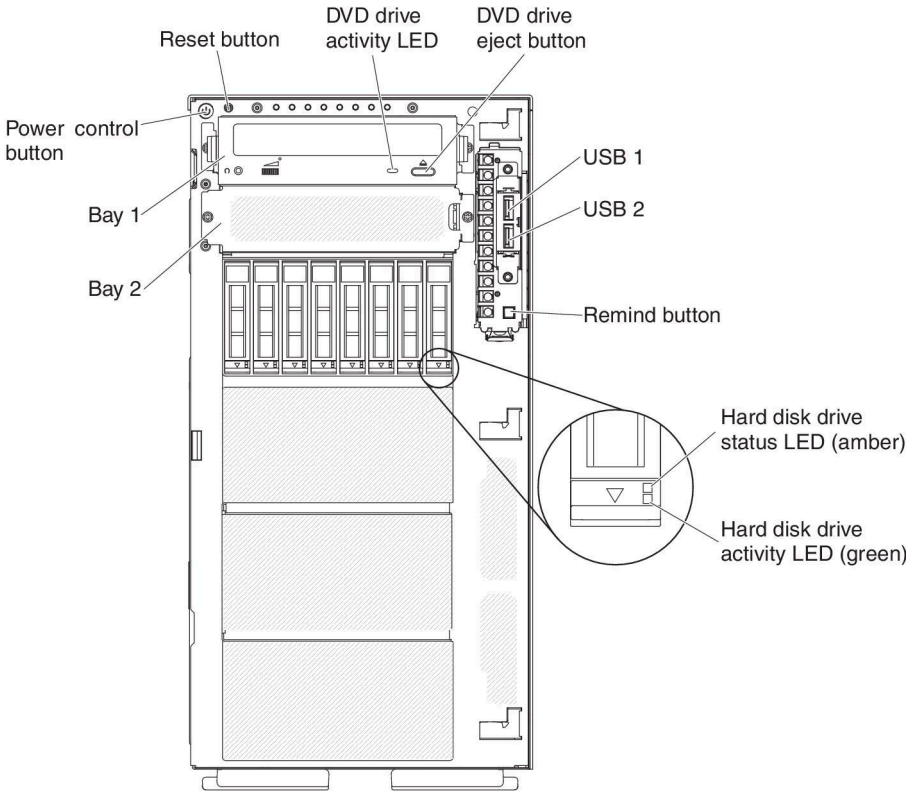
Server controls, LEDs, and power

This section describes the controls and light-emitting diodes (LEDs) and how to turn the server on and off. For the locations of other LEDs on the system board, see “System-board LEDs and controls” on page 34.

Front view

The following illustration shows the controls and LEDs on the front of the server.

Note: The front bezel is not shown so that the drive bays are visible.



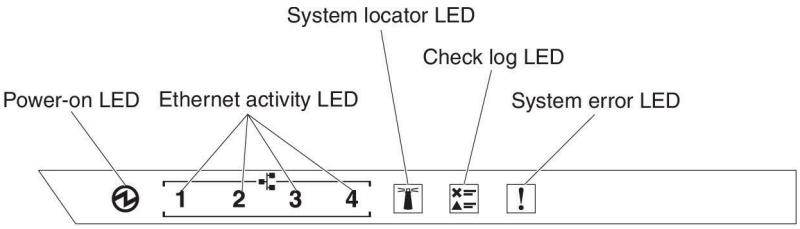
- **Power-control button:** Press this button to turn the server on and off manually.
- **Hard disk drive activity LEDs:** This LED is used on hot-swap SAS or SATA hard disk drives. Each hot-swap hard disk drive has an activity LED, and when this LED is flashing, it indicates that the drive is in use.
- **Hard disk drive status LEDs:** This LED is used on hot-swap SAS or SATA hard disk drives. When this LED is lit, it indicates that the drive has failed. If an optional IBM ServeRAID controller is installed in the server, when this LED is flashing slowly (one flash per second), it indicates that the drive is being rebuilt. When the LED is flashing rapidly (three flashes per second), it indicates that the controller is identifying the drive.
- **DVD drive activity LED:** When this LED is lit, it indicates that the DVD drive is in use.
- **DVD eject button:** Press this button to release a DVD or CD from the DVD drive.
- **Light path diagnostics panel:** Light path diagnostics is a system of LEDs on various external and internal components of the server. When an error occurs, LEDs are lit throughout the server. By viewing the LEDs in a particular order, you can often identify the source of the error. See “Light path diagnostics panel” on page 16 for more information about the light path diagnostics.
- **Operator information panel:** This panel contains controls and LEDs that provide information about the status of the server. For information about the controls and LEDs on the operator information panel, see “Operator information panel” on page 15.
- **Remind button:** This button places the system-error LED/check log LED on the operator information panel into Remind mode. In Remind mode, the system-error LED flashes once every 2 seconds until the problem is corrected, the server is restarted, or a new problem occurs.

By placing the system-error LED indicator in Remind mode, you acknowledge that you are aware of the last failure but will not take immediate action to correct the problem. The remind function is controlled by the IMM2.

- **Reset button:** Press this button to reset the server and run the power-on self-test (POST). You might have to use a pen or the end of a straightened paper clip to press the button. The Reset button is in the lower-right corner of the light path diagnostics panel.
- **USB connectors:** Connect a USB device, such as a USB mouse or keyboard to any of these connectors.

Operator information panel

The following illustration shows the controls and LEDs on the operator information panel.



- **Power-on LED:** When this LED is lit and not flashing, it indicates that the server is turned on. The states of the power-on LED are as follows:

  Off: Power is not present or the power supply, or the LED itself has failed.

  Flashing rapidly (4 times per second): The server is turned off and is not ready to be turned on. The power-control button is disabled. This will last approximately 5 to 10 seconds.

  Flashing slowly (once per second): The server is turned off and is ready to be turned on. You can press the power-control button to turn on the server.

  Lit: The server is turned on.
- **Ethernet activity LEDs:** When any of these LEDs is flashing, they indicate that the server is transmitting to or receiving signals from the Ethernet LAN that is connected to the Ethernet port that corresponds to that LED.
- **System-locator LED:** Use this blue LED to visually locate the server among other servers. You can use IBM Systems Director to light this LED remotely. This LED is controlled by the IMM2. When you light the system-locator LED, the LED will blink and it will continue to blink until you turn it off.
- **Check log LED:** When this yellow LED is lit, it indicates that a system error has occurred. Check the error log for additional information. See the *Problem Determination and Service Guide* on the *System x Documentation* CD for more information about error logs.
- **System-error LED:** When this yellow LED is lit, it indicates that a system error has occurred. An LED on the light path diagnostics panel is lit to help isolate the error. This LED is controlled by the IMM2.

The following table describes the LEDs on the operator information panel and suggested actions to correct the detected problems.

LED	Description	Action
System locator (blue)	Use this LED to visually locate the server among other servers. You can use IBM Systems Director or IMM2 to light this LED remotely.	

LED	Description	Action
Check log (yellow)	An error has occurred and cannot be isolated without performing certain procedures.	1. Check the IMM2 system event log and the system-error log for information about the error. 2. Save the log if necessary and clear the log afterwards.
System-error (yellow)	An error has occurred.	1. Check the light path diagnostics LEDs and follow the instructions. 2. Check the IMM2 system event log and the system-error log for information about the error. 3. Save the log if necessary and clear the log afterwards.

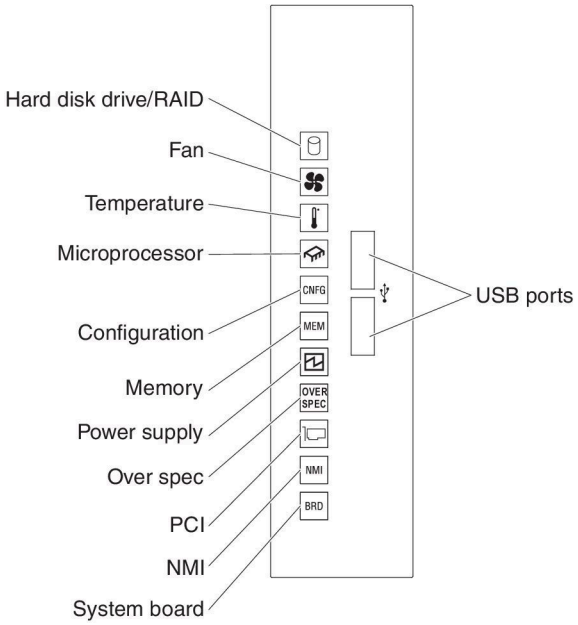
Light path diagnostics panel

The following illustration shows the front LEDs on the light path diagnostics panel. The light path diagnostic panel can be seen from the front bezel.

Note: The light path diagnostics LEDs remain lit only while the server is connected to power.

For more information about the LEDs on the light path diagnostics panel, see “Light path diagnostics LEDs.”

The following illustration shows the LEDs on the light path diagnostics panel.



Light path diagnostics LEDs: The following table describes the LEDs on the light path diagnostics panel and suggested actions to correct the detected problems.

Table 2. Light path diagnostics panel LEDs

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **If an action step is preceded by "(Trained technician only)," that step must be performed only by a trained technician.**

LED	Description	Action
Hard disk drive/ RAID	A hard disk drive has failed or is missing. A SAS controller or a ServeRAID controller error has occurred.	1. Check the LEDs on the hard disk drives for the drive with a lit status LED and reseat the hard disk drive. 2. Reseat the hard disk drive backplane. 3. Check the LEDs near SAS controllers or ServeRAID controllers and reseat the corresponding controllers. 4. For more information, see the “Hard disk drive problems” under the Troubleshooting tables in the *Problem Determination and Service Guide*. 5. If the error remains, replace the following components one at a time, in the order listed, restarting the server after each: a. Replace the hard disk drive. b. Replace the hard disk drive backplane. c. Replace the SAS controller. d. Replace the ServeRAID controller. 6. If the problem remains, go to http://www.ibm.com/systems/support/supportsite.wss/docdisplay?brandind=5000008&lndocid=SERV-CALL.
Fan	A fan has failed, is operating too slowly, or has been removed. The TEMP LED might also be lit.	1. Open the fan cage cover to reseat the failing fan (with lit LED). 2. Replace the failing fan (see “Installing a simple-swap fan” on page 63).
Temperature	The system temperature has exceeded a threshold level. A failing fan can cause the Temperature LED to be lit.	1. Make sure that the heat sink is seated correctly. 2. Determine whether a fan has failed. If it has failed, replace the failing fan. 3. Make sure that the room temperature is not too high. See “Features and specifications” on page 6 for the server temperature information. 4. Make sure that the air vents are not blocked. 5. Make sure that the fan on the adapter and the network adapter is seated correctly. If it has failed, replace the failing component. 6. If the failure remains, go to http://www.ibm.com/systems/support/supportsite.wss/docdisplay?brandind=5000008&lndocid=SERV-CALL.

Table 2. Light path diagnostics panel LEDs (continued)

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **If an action step is preceded by "(Trained technician only)," that step must be performed only by a trained technician.**

LED	Description	Action
Microprocessor	When only the Microprocessor LED is lit, a microprocessor has failed.	If the Configuration LED is not lit, a microprocessor failure occurs, complete the following steps: 1. (Trained technician only) Make sure that the failing microprocessor and its heat sink, which are indicated by a lit LED on the system board, are installed correctly. See "Installing a second microprocessor and heat sink" on page 98 for information about installation and requirements. 2. (Trained technician only) Replace the failing microprocessor (see "Installing a second microprocessor and heat sink" on page 98). 3. If the failure remains, go to http://www.ibm.com/systems/support/supportsite.wss/docdisplay?brandind=5000008&lndocid=SERV-CALL.
	Microprocessor + Configuration When both the Microprocessor and Configuration LEDs are lit, the microprocessor configuration is invalid.	If the Configuration LED and the Microprocessor LED are lit, the system issues an invalid microprocessor configuration error. Complete the following steps to correct the problem: 1. Check the microprocessors that were just installed to make sure that they are compatible with each other (see "Installing a second microprocessor and heat sink" on page 98 for additional information about microprocessor requirements) and use the Setup utility and select **System Information → System Summary → Processor Details** to verify the microprocessors information. 2. (Trained technician only) Replace the incompatible microprocessor. 3. Check the system-error logs for information about the error. Replace any component that is identified in the error log.

Table 2. Light path diagnostics panel LEDs (continued)

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **If an action step is preceded by "(Trained technician only)," that step must be performed only by a trained technician.**

LED	Description	Action
CNFG Configuration	Configuration + Microprocessor A hardware configuration error has occurred.	If the Configuration LED and the Microprocessor LED are lit, complete the following steps to correct the problem: 1. Check the microprocessors that were just installed to make sure that they are compatible with each other (see "Installing a second microprocessor and heat sink" on page 98 for additional information about microprocessor requirements). 2. (Trained technician only) Replace the incompatible microprocessor. 3. Check the system-event logs for information about the error. Replace any component that is identified in the error log.
	Configuration + Memory A hardware configuration error has occurred.	If the Configuration LED and the Memory LED are lit, check the system-event logs for information about the error (see the *Problem Determination and Service Guide* for more information).
	Configuration + Power supply A hardware configuration error has occurred.	If the Configuration LED and the Power supply LED are lit, the system issues an invalid power configuration error. Make sure that both power supplies installed in the server are of the same rating or wattage.
MEM Memory	When only the Memory LED is lit, a memory error has occurred.	**Note:** Each time you install or remove a DIMM, you must disconnect the server from the power source; then, wait 10 seconds before restarting the server. If the Configuration LED is not lit, the system might detect a memory error. Complete the following steps to correct the problem: 1. Reseat or swap the DIMMs with lit LEDs. 2. Check the system-event logs for information about the error (see the *Problem Determination and Service Guide* for more information). 3. Update the server firmware to the latest level (see the *Problem Determination and Service Guide* for more information). 4. Replace the failing DIMM (see "Installing a memory module" on page 77).
	Memory + Configuration When both the Memory and Configuration LEDs are lit, the memory configuration is invalid.	If the Memory LED and the Configuration LED are lit, check the system-event logs for information about the error (see the *Problem Determination and Service Guide* for more information).

Table 2. Light path diagnostics panel LEDs (continued)

- **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.**
- **If an action step is preceded by "(Trained technician only)," that step must be performed only by a trained technician.**

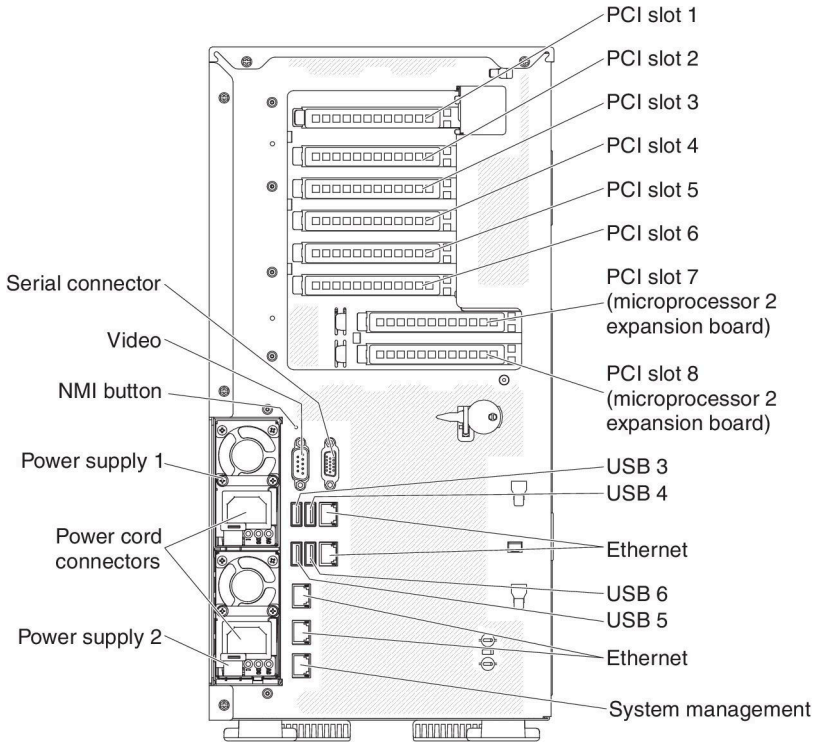
LED	Description	Action
Power supply	When only the Power supply LED is lit, a power supply has failed.	If the CONFIG LED is not lit, the system might detect a power supply error. Complete the following steps to correct the problem: 1. Check the power-supply with an lit yellow LED (see "Power-supply LEDs" on page 24). 2. Make sure that the power supplies are seated correctly and plugged in a good AC outlet. 3. Remove one of the power supplies to isolate the failed power supply. 4. Make sure that both power supplies installed in the server are of the same voltage. 5. Replace the failed power supply (see "Installing a hot-swap power supply" on page 106).
	Power supply + Configuration When both the Power supply and Configuration LEDs are lit, the power supply configuration is invalid.	If the PS LED and the CONFIG LED are lit, the system issues an invalid power configuration error. Make sure that both power supplies installed in the server are of the same rating or wattage.
Over spec	The power supplies are using more power than their maximum rating.	If the Over spec LED on the light path diagnostics panel is lit, complete the following steps in order until the problem is solved: 1. Add a second power supply. 2. Replace the failed power supply. 3. Remove the optional devices.
PCI	An error has occurred on a PCI card or a PCI bus.	1. Check if any PCI slot error LED is lit to identify the component that caused the error. 2. Check the system-error log for information about the error. 3. If you cannot isolate the failing component by using the LEDs and the information in the system-event logs, remove one component at a time; and restart the server after each component is removed. 4. If the failure remains, go to http://www.ibm.com/systems/support/supportsite.wss/docdisplay?brandind=5000008&lndocid=SERV-CALL.
NMI	A nonmaskable interrupt has occurred, or the NMI button was pressed.	1. Check the system-event logs for information about the error. 2. Restart the server.

Table 2. Light path diagnostics panel LEDs (continued)

• **Follow the suggested actions in the order in which they are listed in the Action column until the problem is solved.** • **If an action step is preceded by "(Trained technician only)," that step must be performed only by a trained technician.**		
LED	**Description**	**Action**
BRD System board	An error has occurred on the system battery, the microprocessor 2 expansion board, the power paddle card, or the system board.	1. Check the LEDs on the system board to identify the component that caused the error. The System board LED can be lit due to any of the following reasons: • Battery • Microprocessor 2 expansion board • Power paddle card • (Trained technician only) System board 2. Check the system-event logs for information about the error. 3. Replace the failing component: • Battery • Microprocessor 2 expansion board • Power paddle card • (Trained technician only) System board

Rear view

The following illustration shows the connectors on the rear of the server.



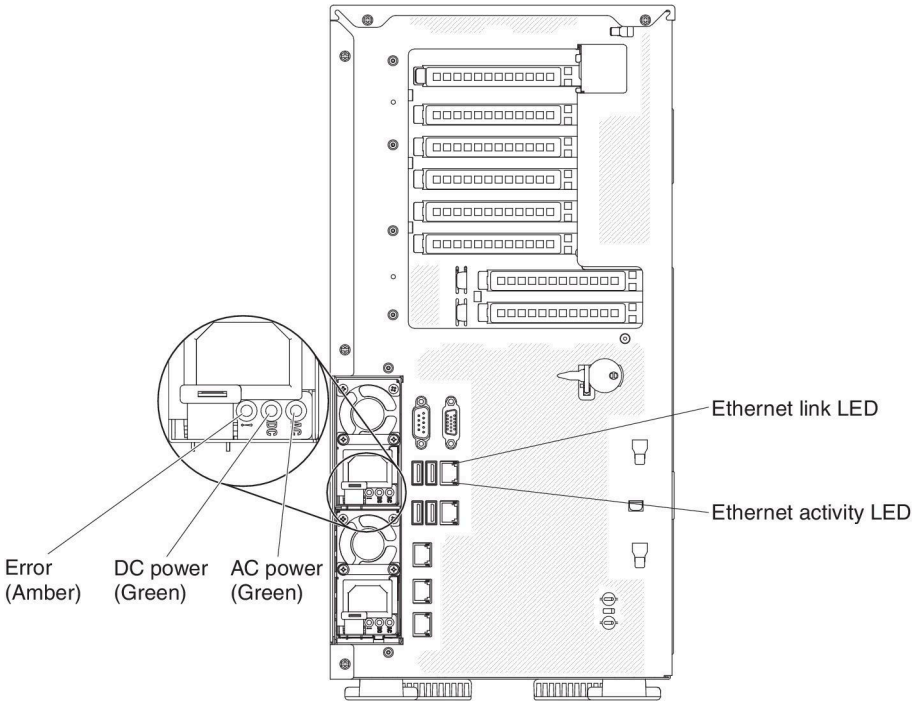
- **NMI button:** Press this button to force a nonmaskable interrupt to the microprocessor. It allows you to blue screen the server and take a memory dump (use this button only when directed by the IBM service support). You might have to use a pen or the end of a straightened paper clip to press the button.

- **PCI slot 1:** Insert a half-length, full-height PCI Express adapter or a PCI-X interposer card into this slot.
- **PCI slot 2:** Insert a half-length, full-height PCI Express adapter into this slot.
- **PCI slot 3:** Insert a full-length, full-height PCI Express adapter into this slot.
- **PCI slot 4:** Insert a full-length, full-height PCI Express adapter into this slot.
- **PCI slot 5:** Insert a full-length, full-height PCI Express adapter into this slot (support 225W GPU).
- **PCI slot 6:** Insert a full-length, full-height PCI Express adapter into this slot.
- **PCI slot 7:** Insert a full-length, full-height PCI Express adapter into this slot (support 225W GPU).
- **PCI slot 8:** Insert a full-length, full-height PCI Express adapter into this slot.
- **Power connector:** Connect the power cord to this connector.

  Note: Power supply 1 is the default/primary power supply. If power supply 1 fails, you must replace it immediately.
- **Video connector:** Connect a monitor to this connector.

  Note: The maximum video resolution is 1600 x 1200 at 75 Hz.
- **Serial connector:** Connect a 9-pin serial device to this connector. The serial port is shared with the integrated management module II (IMM2). The IMM2 can take control of the shared serial port to redirect serial traffic, using Serial over LAN (SOL).
- **USB connectors:** Connect a USB device, such as a USB mouse or keyboard to any of these connectors.
- **Systems-management Ethernet connector:** Use this connector to connect the server to a network for full systems-management information control. This connector is used only by the integrated management module II (IMM2). A dedicated management network provides additional security by physically separating the management network traffic from the production network. You can use the Setup utility to configure the server to use a dedicated systems management network or a shared network.
- **Ethernet connectors:** Use either of these connectors to connect the server to a network. When you enable shared Ethernet for IMM2 in the Setup utility, you can access the IMM2 using either the Ethernet 1 or the system-management Ethernet connector.

The following illustration shows the LEDs on the rear of the server.

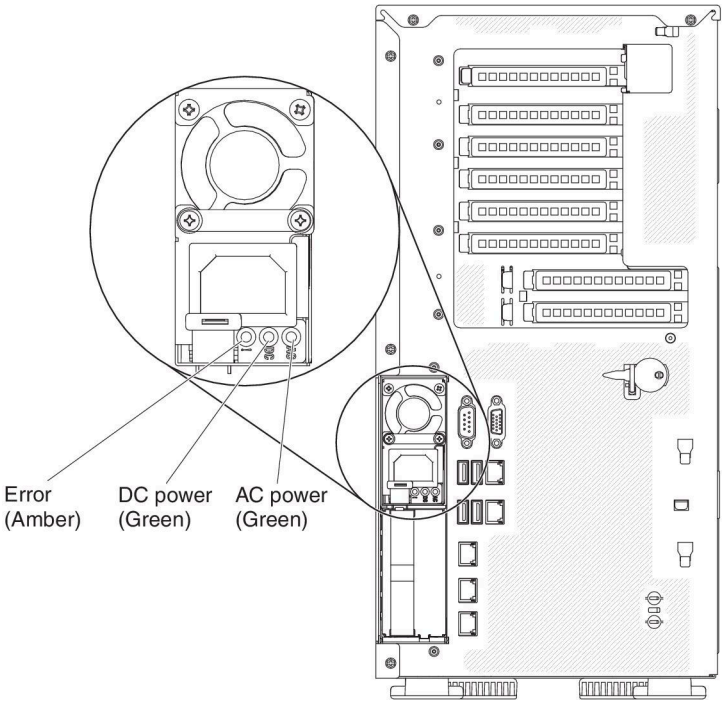


- **Ethernet activity LEDs:** When these LEDs are lit, they indicate that the server is transmitting to or receiving signals from the Ethernet LAN that is connected to the Ethernet port.
- **Ethernet link LEDs:** When these LEDs are lit, they indicate that there is an active link connection on the Ethernet port.
- **AC power LED:** Each hot-swap power supply has an ac power LED. When the ac power LED is lit, it indicates that sufficient power is coming into the power supply through the power cord. During typical operation, the ac power LED is lit. For any other combination of LEDs, see the *Problem Determination and Service Guide* on the IBM *System x Documentation* CD.
- **DC power LED:** Each hot-swap power supply has a dc power LED and an ac power LED. When the dc power LED is lit, it indicates that the power supply is supplying adequate dc power to the system. During typical operation, both the ac and dc power LEDs are lit. For any other combination of LEDs, see the *Problem Determination and Service Guide* on the IBM *System x Documentation* CD.
- **Power-supply error LED:** When the power-supply error LED is lit, it indicates that the power supply has failed.

  Note: Power supply 1 is the default/primary power supply. If power supply 1 fails, you must replace the power supply immediately.

Power-supply LEDs

The following illustration shows the location of the power-supply LEDs on the rear of the server. See the *Problem Determination and Service Guide* for additional information about solving power-supply problems.



The following table describes the problems that are indicated by various combinations of the power-supply LEDs on an ac power supply and suggested actions to correct the detected problems.

AC power-supply LEDs			Description	Action	Notes
AC	**DC**	**Error (!)**			
On	On	Off	Normal operation.		
Off	Off	Off	No ac power to the server or a problem with the ac power source.	1. Check the ac power to the server. 2. Make sure that the power cord is connected to a functioning power source. 3. Restart the server. If the error remains, check the power-supply LEDs. 4. If the problem remains, replace the power-supply.	This is a normal condition when no ac power is present.
Off	Off	On	Faulty power-supply.	1. Make sure that the power cord is connected to a functioning power source. 2. Replace the power supply.	This happens only when a second power supply is providing power to the server.
Off	On	Off	Faulty power-supply.	Replace the power supply.	
Off	On	On	Faulty power-supply.	Replace the power supply.	
On	Off	Off	Power-supply not fully seated, faulty system board, or faulty power-supply.	1. Reseat the power supply. 2. If the system board error LED is not lit, replace the power supply. 3. (Trained technician only) If the system board error LED is lit, replace the system board.	Typically indicates a power-supply is not fully seated.
On	Off or Flashing	On	Faulty power-supply.	Replace the power supply.	
On	On	On	Power supply is faulty but still operational	Replace the power supply.	

System pulse LEDs

The following LEDs are on the system board and monitor the system power-on and power-off sequencing and boot progress (see “System-board LEDs and controls” on page 34 for the location of these LEDs):

Table 3. System pulse LEDs

LED	Description	Action
RTMM heartbeat	Power-on and power-off sequencing.	1. If the LED blinks at 1Hz, it is functioning properly and no action is necessary. 2. If the LED is not blinking, (trained technician only) replace the system board.
IMM2 heartbeat	IMM2 heartbeat boot process.	The following steps describe the different stages of the IMM2 heartbeat sequencing process. 1. When this LED is blinking fast (approximately 4Hz), this indicates, that the IMM2 code is in the loading process. 2. When this LED goes off momentarily, this indicates that the IMM2 code has loaded completely. 3. When this LED goes off momentarily and then starts blinking slowing (approximately 1Hz), this indicates that IMM2 is fully operational. You can now press the power-control button to power-on the server. 4. If this LED does not blink within 30 seconds of connecting a power source to the server, (trained technician only) Replace the system board.

Server power features

When the server is connected to an ac power source but is not turned on, the operating system does not run, and all core logic except for the integrated management module II (IMM2) is shut down; however, the server can respond to requests from IMM2, such as a remote request to turn on the server. The power-on LED flashes to indicate that the server is connected to an ac power source but is not turned on.

Turning on the server

Approximately 5 seconds after the server is connected to power, one or more fans might start running to provide cooling while the server is connected to power and the power-on button LED will blink quickly. Approximately 5 to 10 seconds after the server is connected to power, the power-control button becomes active (the power-on LED will blink slowly), and one or more fans might start running to provide cooling while the server is connected to power. You can turn on the server by pressing the power-control button.

The server can also be turned on in any of the following ways:

- If a power failure occurs while the server is turned on, the server will restart automatically when power is restored.
- If your operating system supports the Wake on LAN feature, the Wake on LAN feature can turn on the server.

Notes:

1. When 4 GB or more of memory (physical or logical) is installed, some memory is reserved for various system resources and is unavailable to the operating system. The amount of memory that is reserved for system resources depends on the operating system, the configuration of the server, and the configured PCI options.
2. When you turn on the server with external graphical adapters installed, the IBM logo displays on the screen after approximately 3 minutes. This is normal operation while the system loads.
3. Make sure the left-side cover is closed.

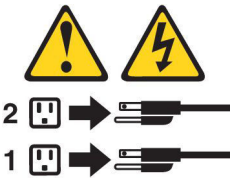
Turning off the server

When you turn off the server and leave it connected to power, the server can respond to requests to the service processor, such as a remote request to turn on the server. While the server remains connected to power, one or more fans might continue to run. To remove all power from the server, you must disconnect it from the power source.

Some operating systems require an orderly shutdown before you turn off the server. See your operating-system documentation for information about shutting down the operating system.

Statement 5:

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



The server can be turned off in any of the following ways:

- You can turn off the server from the operating system, if your operating system supports this feature. After an orderly shutdown of the operating system, the server will turn off automatically.
- You can press the power-control button to start an orderly shutdown of the operating system and turn off the server, if your operating system supports this feature.

- If the operating system stops functioning, you can press and hold the power-control button for more than 4 seconds to turn off the server.
- The server can be turned off by Wake on LAN feature with the following limitation:

  Note: When you install any PCI adapter, the power cords must be disconnected from the power source before you remove the PCI Express assembly and the PCI-X assembly. Otherwise, the active power management event signal will be disabled by the system-board logic, and the Wake on LAN feature might not work. However, after the server is powered-on locally, the active power management event signal will be enabled by the system-board logic.
- The integrated management module II (IMM2) can turn off the server as an automatic response to a critical system failure.
- The server turns off when the left-side cover is opened.

Chapter 2. Installing optional devices

This chapter provides detailed instructions for installing optional hardware devices in the server.

Instructions for IBM Business Partners

In addition to the instructions in this chapter for installing optional hardware devices, updating firmware and device drivers, and completing the installation, IBM Business Partners must also complete the following steps:

1. After you have confirmed that the server starts correctly and recognizes the newly installed devices and that no error LEDs are lit, run the Dynamic System Analysis (DSA) stress tests. For information about using DSA, see the *Problem Determination and Service Guide*.
2. Shut down and restart the server multiple times to ensure that the server is correctly configured and functions correctly with the newly installed devices.
3. Save the DSA log as a file and send it to IBM. For information about transferring data and logs, see http://publib.boulder.ibm.com/infocenter/toolsctr/v1r0/index.jsp?topic=/dsa/dsa_main.html.
4. To ship the server, repackage it in the original undamaged packing material and observe IBM procedures for shipping.

Support information for IBM Business Partners is available at http://www.ibm.com/partnerworld/.

How to send DSA data to IBM

Before you send diagnostic data to IBM, read the terms of use at http://www.ibm.com/de/support/ecurep/terms.html.

You can use any of the following methods to send diagnostic data to IBM:

- **Standard upload:** http://www.ibm.com/de/support/ecurep/send_http.html
- **Standard upload with the system serial number:** http://www.ecurep.ibm.com/app/upload_hw
- **Secure upload:** http://www.ibm.com/de/support/ecurep/send_http.html#secure
- **Secure upload with the system serial number:** https://www.ecurep.ibm.com/app/upload_hw

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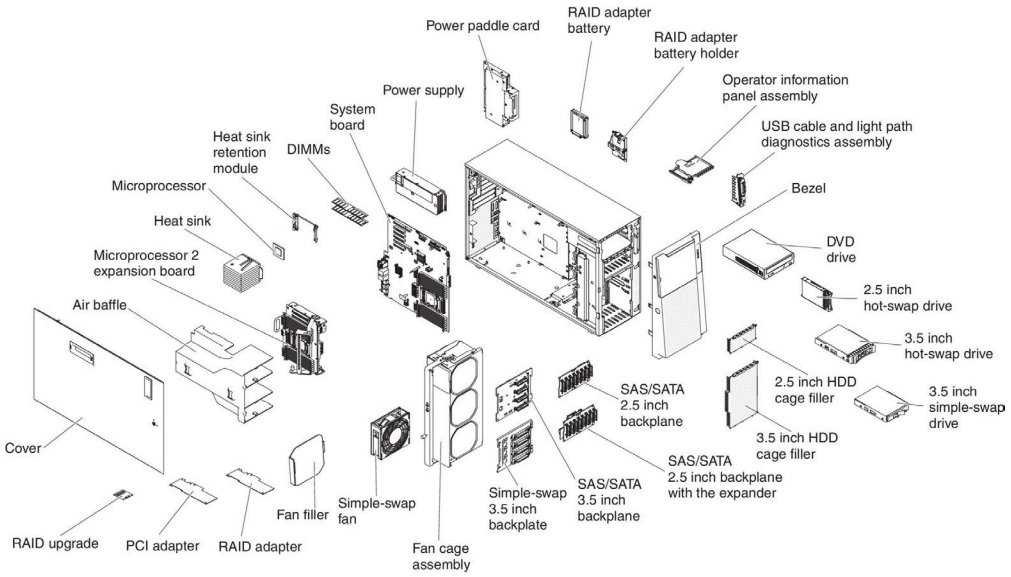
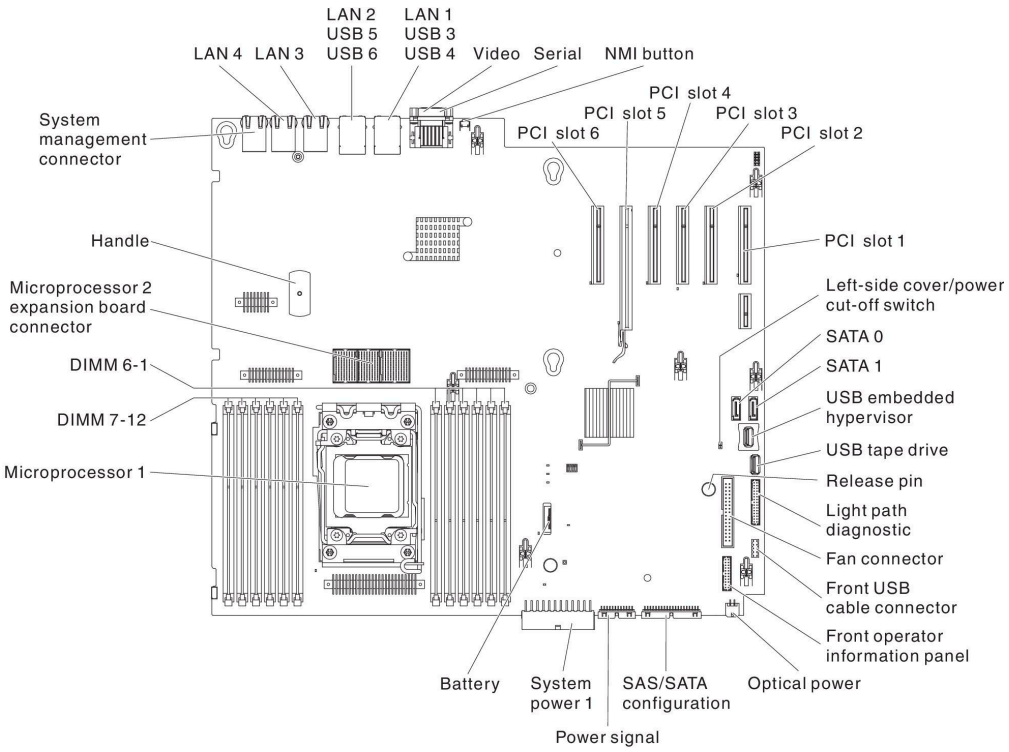
Server components

The following illustration shows the major components in the server. The illustrations in this document might differ slightly from your hardware.

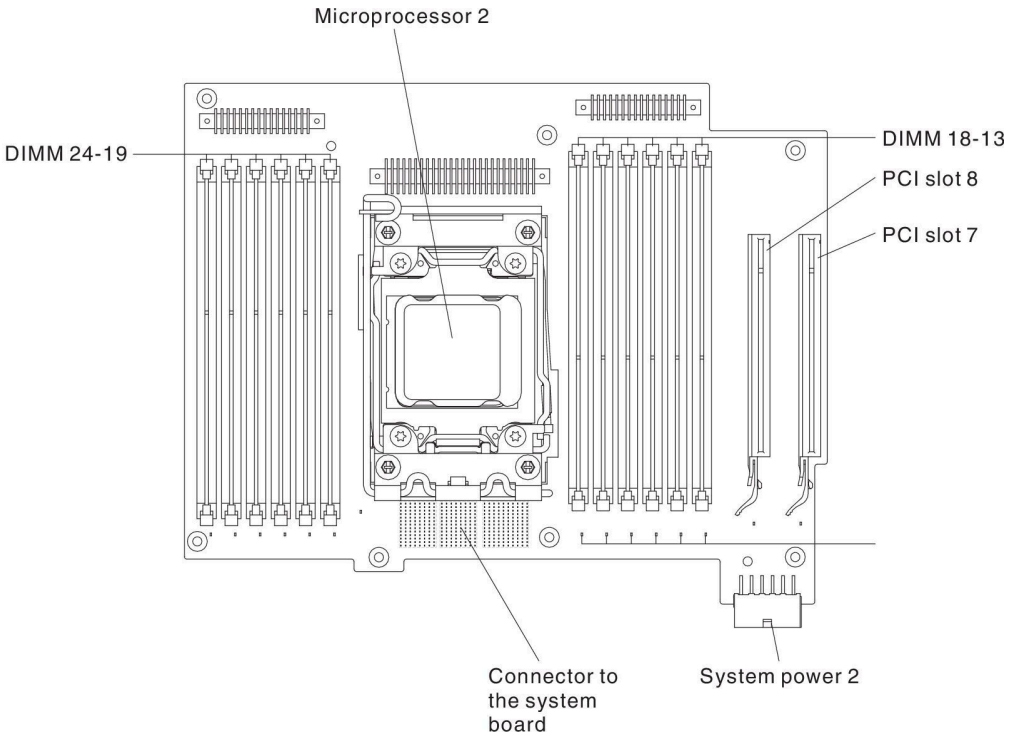


System-board internal connectors

The following illustration shows the internal connectors on the system board.

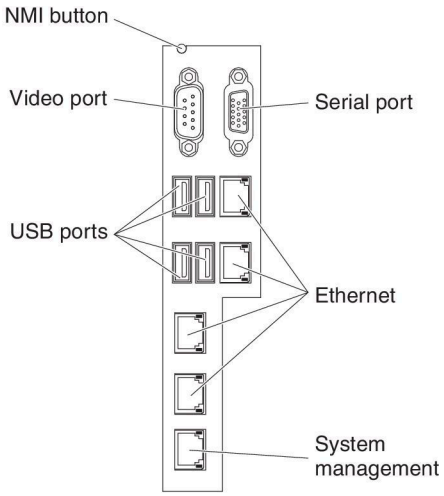


The following illustration shows the internal connectors on the microprocessor 2 expansion board.



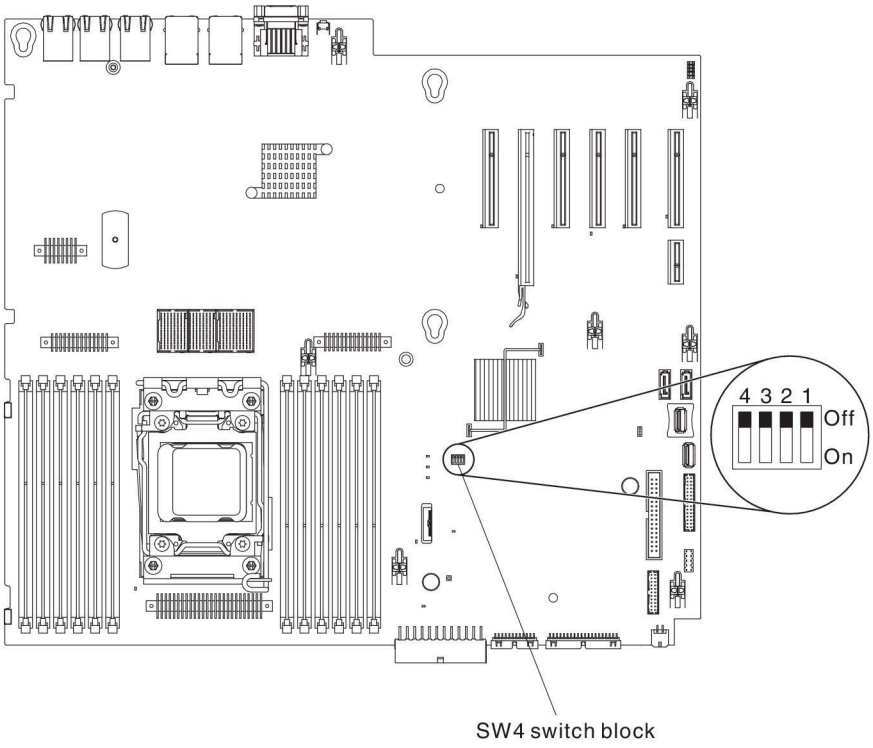
System-board external connectors

The following illustration shows the external connectors on the system board.



System-board switches and jumpers

The following illustration shows the location and description of the switches and jumpers.



Note: If there is a clear protective sticker on the top of the switch blocks, you must remove and discard it to access the switches.

The following table describes the functions of the SW4 switch block on the system board.

Table 4. System board SW4 switch block definition

Switch number	Switch name	Default position	Description
1	UEFI boot backup	Off	When this switch is off, the primary firmware ROM page is loaded. When this switch is on, the secondary (backup) firmware ROM page is loaded. **Note:** Changing the position of the UEFI boot back switch before the server is turned on alters which flash ROM page is loaded. Do not move the switch after the server is turned on. This can cause an unpredictable problem.
2	System TPM physical presence	Off	Indicates a physical presence to the system TPM when on.
3	Power-on password override	Off	Bypasses the power-on password check the next time the server is turned on and starts the Setup utility so that you can change or delete the power-on password when on. **Notes:** 1. You do not have to move the switch back to the default position after the power-on password in overridden. 2. Changing the position of this switch does not affect the administrator password check if an administrator password is set. See “Passwords” on page 124 for additional information about passwords.
4	CMOS clear	Off	Clears CMOS memory when on.

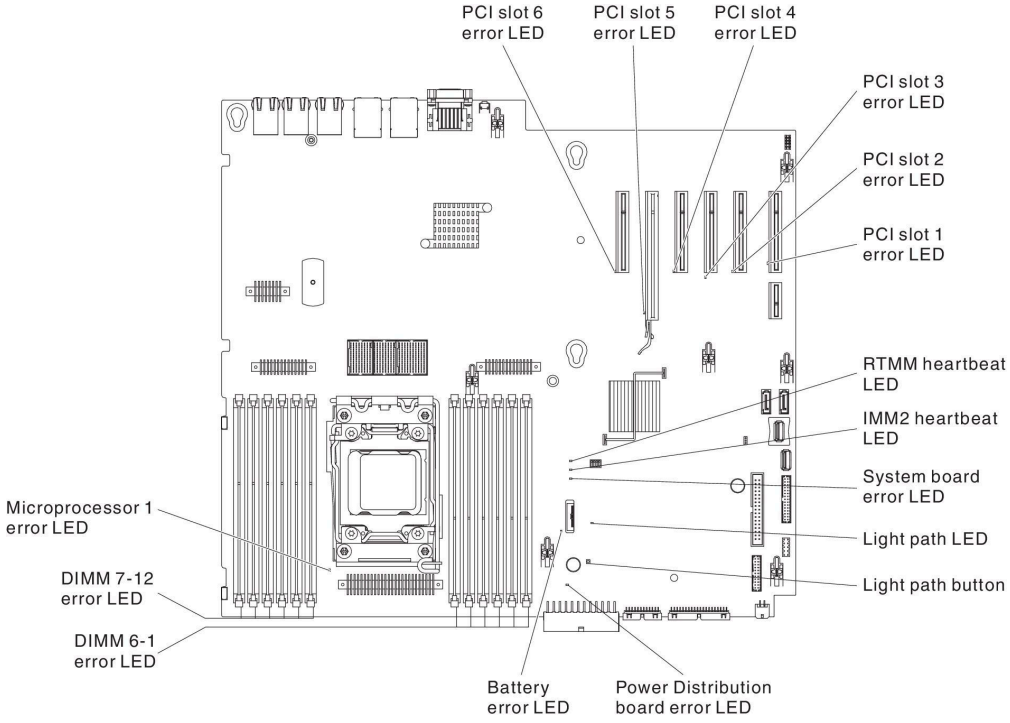
Notes:

1. Before you change any switch settings or move any jumpers, turn off the server. Review the information in vii, “Installation guidelines” on page 37, “Handling static-sensitive devices” on page 39, and “Turning off the server” on page 27.

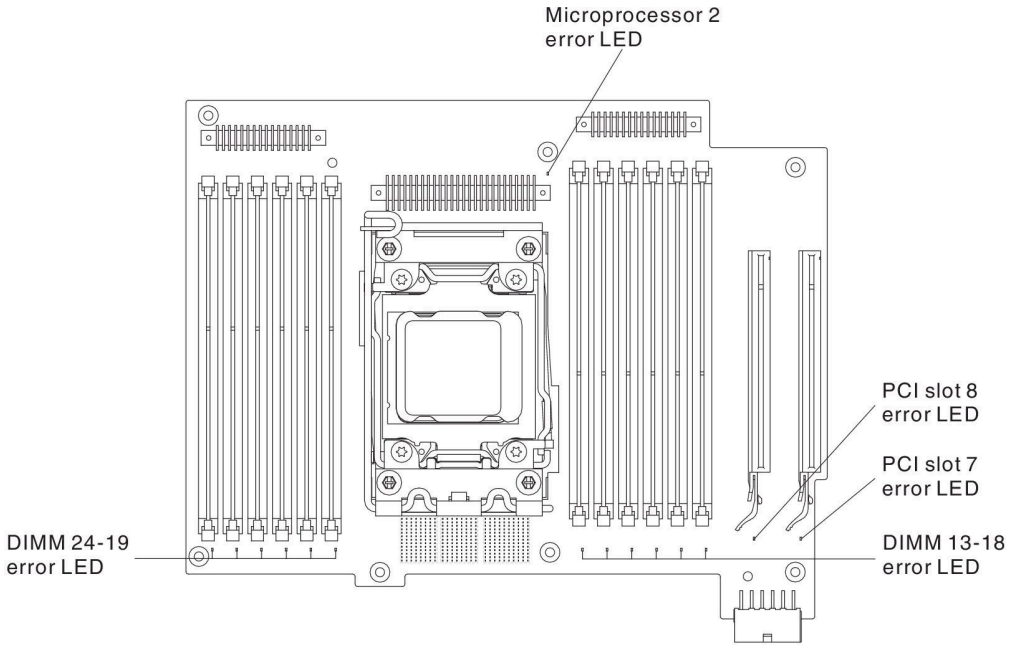
2. Any system-board switch or jumper block that is not shown in the illustrations in this document are reserved.

System-board LEDs and controls

Any error LED can be lit after ac power has been removed from the system-board tray so that you can isolate a problem. After ac power has been removed from the system-board tray, power remains available to these LEDs for up to 90 seconds. To view the error LEDs, press and hold the light path button on the system board to light the error LEDs. The error LEDs that were lit while the system-board tray was running will be lit again while the button is pressed. The following illustration shows the LEDs and controls on the system board.


PCI slot 6 error LED
PCI slot 5 error LED
PCI slot 4 error LED
PCI slot 3 error LED
PCI slot 2 error LED
PCI slot 1 error LED
RTMM heartbeat LED
IMM2 heartbeat LED
System board error LED
Light path LED
Light path button
Microprocessor 1 error LED
DIMM 7-12 error LED
DIMM 6-1 error LED
Battery error LED
Power Distribution board error LED

The following illustration shows the LEDs on the microprocessor 2 expansion board.



Hard disk drive backplane connectors

The following illustrations show the connectors on the 2.5-inch and 3.5-inch hard disk drive backplanes and the backplate assembly.

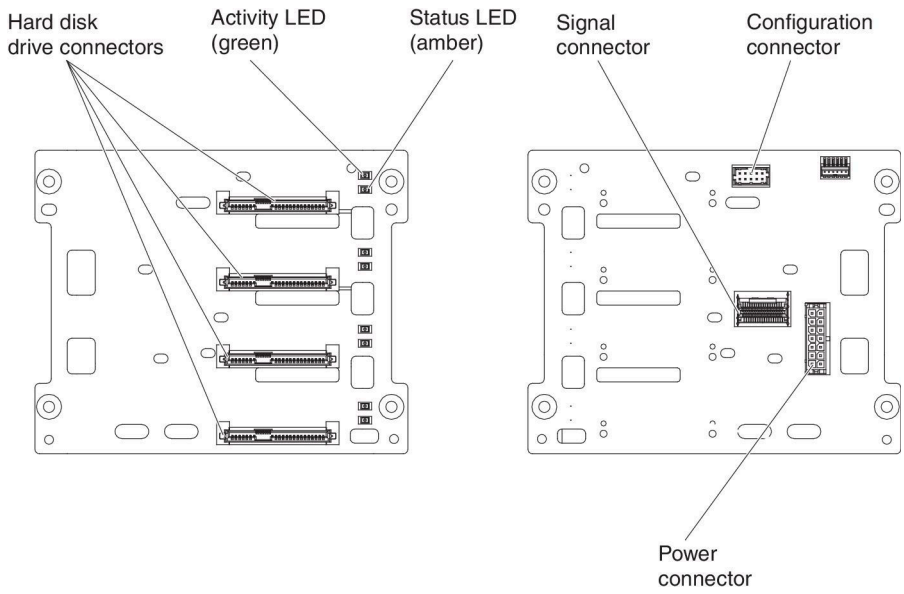


Figure 1. Connectors on the 3.5-inch hard disk drive backplane

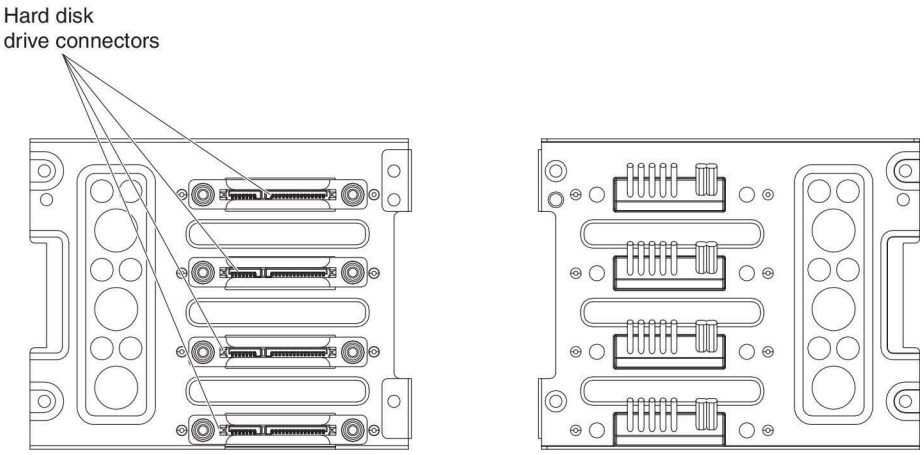


Figure 2. Connectors on the 3.5-inch hard disk drive backplate assembly

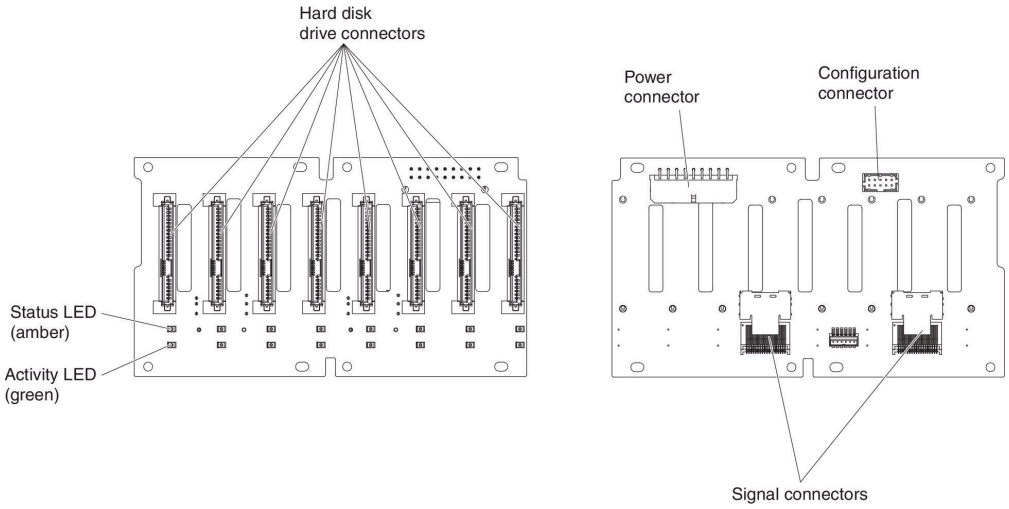


Figure 3. Connectors on the 2.5-inch hard disk drive backplane

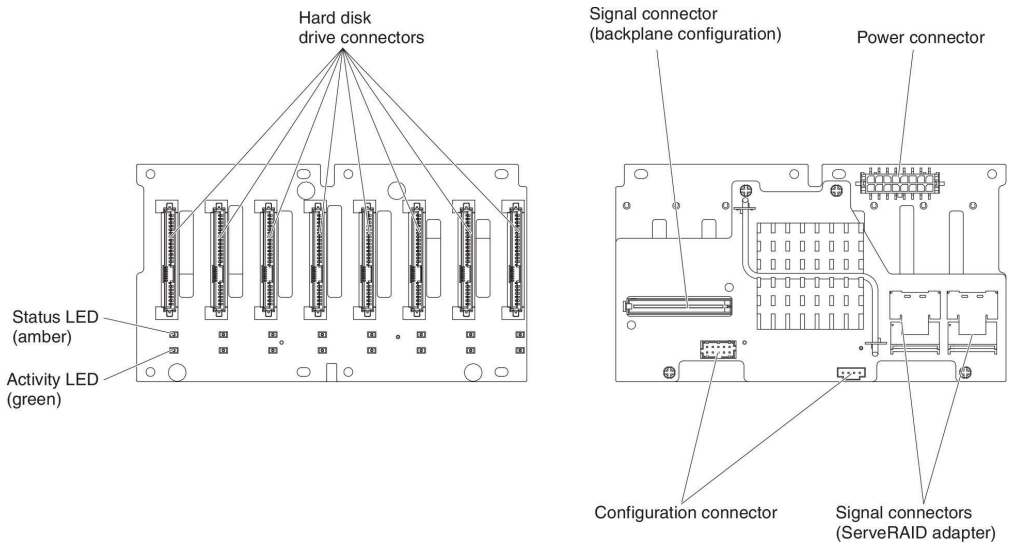


Figure 4. Connectors on the 2.5-inch hard disk drive backplane with the expander

Installation guidelines

Attention: Static electricity that is released to internal server components when the server is powered-on might cause the system to halt, which might result in the loss of data. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding system when removing or installing a hot-swap device.

Before you install optional devices, read the following information:

- Make sure that the devices that you are installing are supported. For a list of supported optional devices for the server, see http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/.
- Read the safety information that begins on page vii and the guidelines in "Working inside the server with the power on" on page 39, and "Handling static-sensitive devices" on page 39. This information will help you work safely.
- When you install your new server, take the opportunity to download and apply the most recent firmware updates. This step will help to ensure that any known issues are addressed and that your server is ready to function at maximum levels of performance. To download firmware updates for your server, go to http://www.ibm.com/support/fixcentral/.

  Important: Some cluster solutions require specific code levels or coordinated code updates. If the device is part of a cluster solution, verify that the latest level of code is supported for the cluster solution before you update the code.

  For additional information about tools for updating, managing, and deploying firmware, see the ToolsCenter for System x and BladeCenter at http://publib.boulder.ibm.com/infocenter/toolsctr/v1r0/index.jsp.
- Before you install optional hardware, make sure that the server is working correctly. Start the server, and make sure that the operating system starts, if an operating system is installed, or that a 19990305 error code is displayed, indicating that an operating system was not found but the server is otherwise

working correctly. If the server is not working correctly, see the *Problem Determination and Service Guide* on the IBM *System x Documentation* CD for diagnostic information.

- Observe good housekeeping in the area where you are working. Place removed covers and other parts in a safe place.
- If you must start the server while the server cover is removed, make sure that no one is near the server and that no tools or other objects have been left inside the server.
- Do not attempt to lift an object that you think is too heavy for you. If you have to lift a heavy object, observe the following precautions:
  - Make sure that you can stand safely without slipping.
  - Distribute the weight of the object equally between your feet.
  - Use a slow lifting force. Never move suddenly or twist when you lift a heavy object.
  - To avoid straining the muscles in your back, lift by standing or by pushing up with your leg muscles.
- Make sure that you have an adequate number of properly grounded electrical outlets for the server, monitor, and other devices.
- Back up all important data before you make changes to disk drives.
- Have a small flat-blade screwdriver, a small Phillips screwdriver, and a T8 torx screwdriver available.
- You do not have to turn off the server to install or replace hot-swap power supplies, or hot-plug Universal Serial Bus (USB) devices. However, you must turn off the server before you perform any steps that involve removing or installing adapter cables and you must disconnect the power source from the server before you perform any steps that involve removing or installing a riser card.
- Blue on a component indicates touch points, where you can grip the component to remove it from or install it in the server, open or close a latch, and so on.
- Orange on a component or an orange label on or near a component indicates that the component can be hot-swapped, which means that if the server and operating system support hot-swap capability, you can remove or install the component while the server is running. (Orange can also indicate touch points on hot-swap components.) See the instructions for removing or installing a specific hot-swap component for any additional procedures that you might have to perform before you remove or install the component.
- When you are finished working on the server, reinstall all safety shields, guards, labels, and ground wires.
- For a list of supported optional devices for the server, see http://www.ibm.com/servers/eserver/serverproven/compat/us/.

System reliability guidelines

To help ensure proper system cooling and system reliability, make sure that the following requirements are met:

- Each of the drive bays has a drive or a filler panel and electromagnetic compatibility (EMC) shield installed in it.
- If the server has redundant power, each of the power-supply bays has a power supply installed in it.
- There is adequate space around the server to allow the server cooling system to work properly. Leave approximately 50 mm (2.0 in.) of open space around the front and rear of the server. Do not place objects in front of the fans. For proper cooling and airflow, replace the server cover before you turn on the server.

Operating the server for extended periods of time (more than 30 minutes) with the server cover removed might damage server components.

- You have followed the cabling instructions that come with optional adapters.
- You have replaced a failed fan within 48 hours.
- You have replaced a hot-swap drive within 2 minutes of removal.
- You do not operate the server without the air baffle or the fan filler installed. Operating the server without the air baffle or the fan filler might cause the microprocessor to overheat.

  Note: The air baffle comes with the microprocessor 2 expansion board option.
- Microprocessor socket 2 always contains either a socket cover or a microprocessor and heat sink.
- You have installed the air baffle and fan 2 when you installed the microprocessor 2 expansion board option.

Note: Do not install the ServeRAID M5120 SAS/SATA adapter in slot 4, 7, and 8 for proper cooling.

Working inside the server with the power on

Attention: Static electricity that is released to internal server components when the server is powered-on might cause the server to halt, which might result in the loss of data. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding system when you work inside the server with the power on.

The server supports hot-plug, hot-add, and hot-swap devices and is designed to operate safely while it is turned on and the server cover is removed. Follow these guidelines when you work inside a server that is turned on:

Note: In order to work inside the server with the power on, you have to disable the power cut-off switch before removing the server cover.

- Avoid wearing loose-fitting clothing on your forearms. Button long-sleeved shirts before working inside the server; do not wear cuff links while you are working inside the server.
- Do not allow your necktie or scarf to hang inside the server.
- Remove jewelry, such as bracelets, necklaces, rings, and loose-fitting wrist watches.
- Remove items from your shirt pocket, such as pens and pencils, that could fall into the server as you lean over it.
- Avoid dropping any metallic objects, such as paper clips, hairpins, and screws, into the server.

Handling static-sensitive devices

Attention: Static electricity can damage the server and other electronic devices. To avoid damage, keep static-sensitive devices in their static-protective packages until you are ready to install them.

To reduce the possibility of damage from electrostatic discharge, observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.

- The use of a grounding system is recommended. For example, wear an electrostatic-discharge wrist strap, if one is available. Always use an electrostatic-discharge wrist strap or other grounding system when working inside the server with the power on.
- Handle the device carefully, holding it by its edges or its frame.
- Do not touch solder joints, pins, or exposed circuitry.
- Do not leave the device where others can handle and damage it.
- While the device is still in its static-protective package, touch it to an unpainted metal surface on the outside of the server for at least 2 seconds. This drains static electricity from the package and from your body.
- Remove the device from its package and install it directly into the server without setting down the device. If it is necessary to set down the device, put it back into its static-protective package. Do not place the device on the server cover or on a metal surface.
- Take additional care when handling devices during cold weather. Heating reduces indoor humidity and increases static electricity.

Internal cable routing and connectors

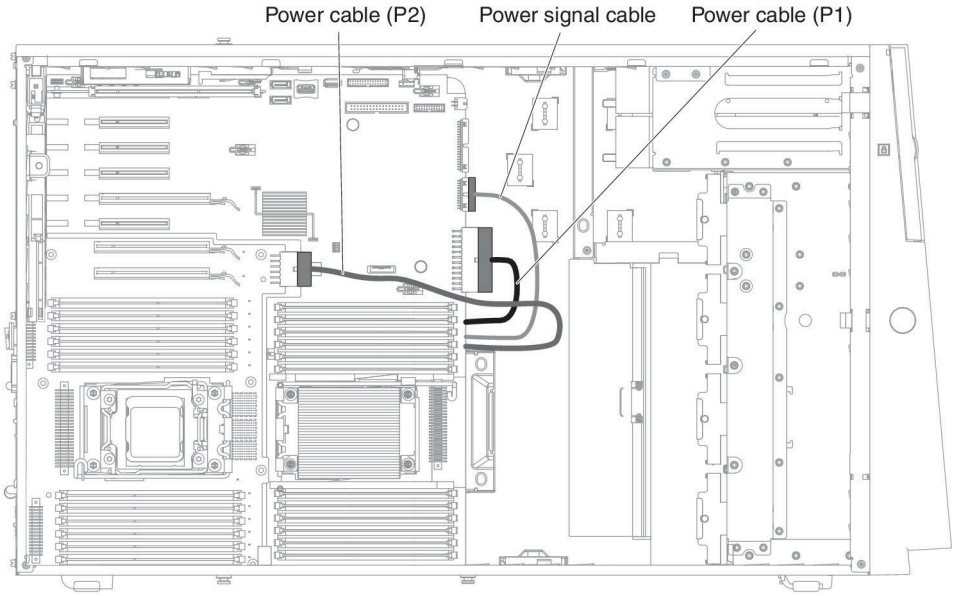
The server uses cables to connect SATA attached, hot-swap SATA, hot-swap SAS and DVD drive devices to the power supply and to the system board.

Review the following information before connecting power and signal cables to internal drives:

- The drives that are preinstalled in the server come with power and signal cables attached. If you replace any drives, remember which cable is attached to which drive.
- When you route a cable, make sure that it does not block the airflow to the rear of the drives or over the microprocessor or DIMMs.

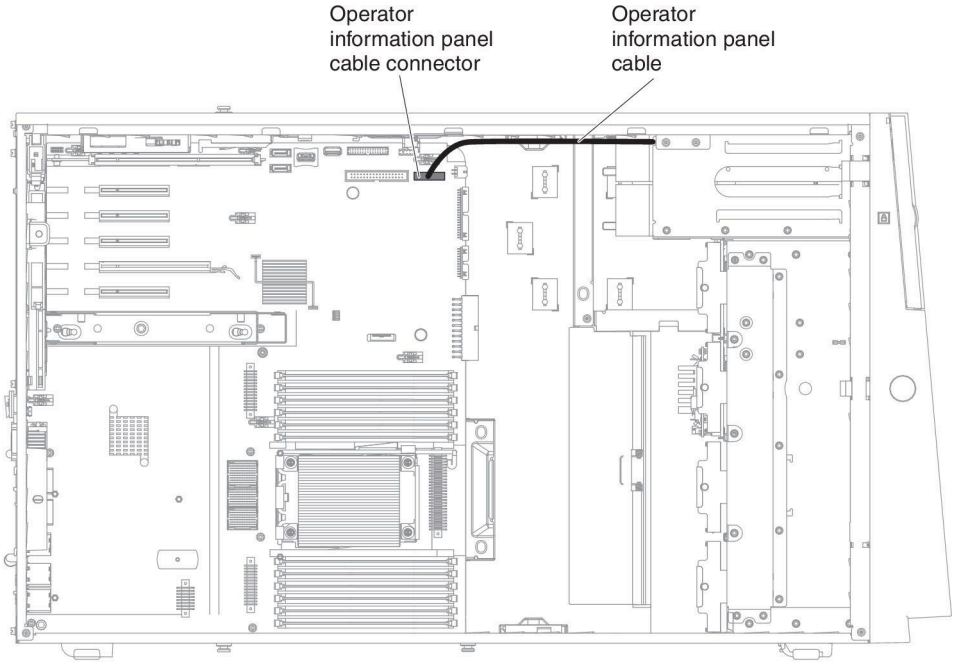
Power cable connection

The following illustration shows the power cable routing and the connectors from the power paddle card to the system board and the microprocessor 2 expansion board.



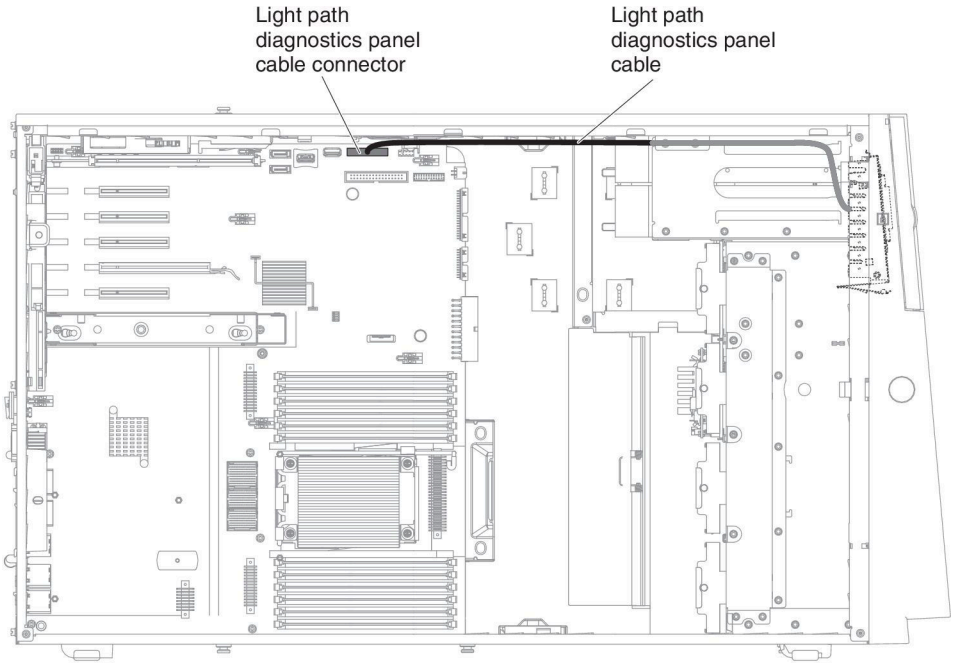
Operator information panel cable connection

The following illustration shows the internal cable routing and connectors from the operator information panel to the system board.



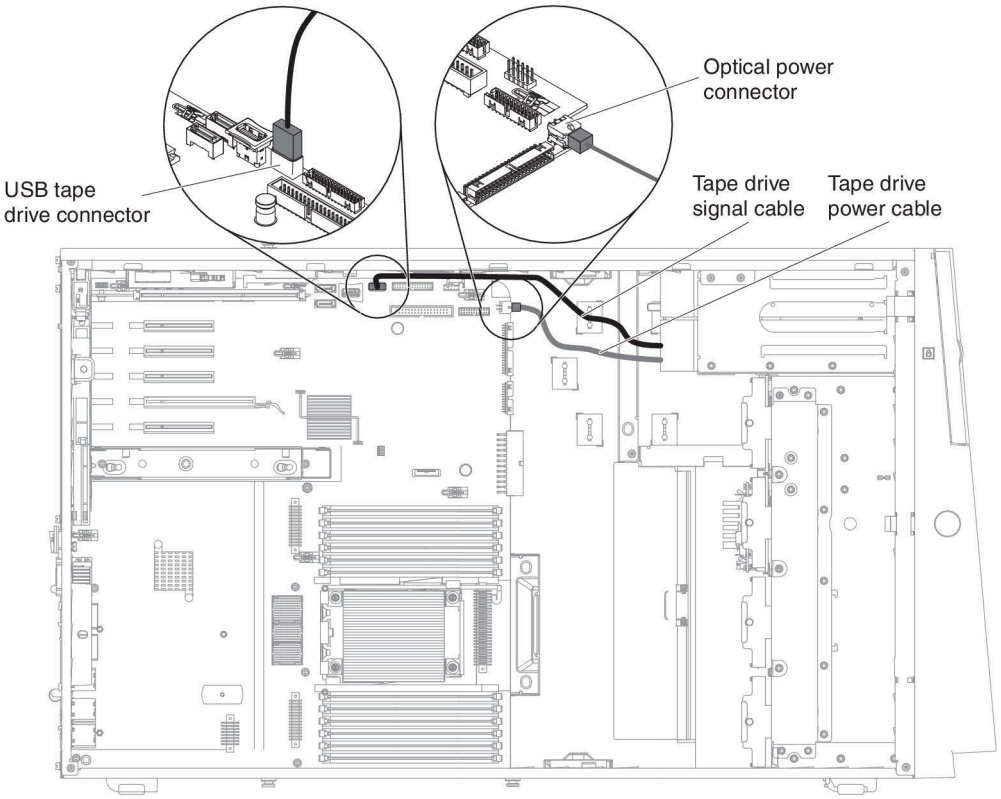
Light path diagnostics panel cable connection

The following illustration shows the internal cable routing and connectors from the light path diagnostics panel to the system board.

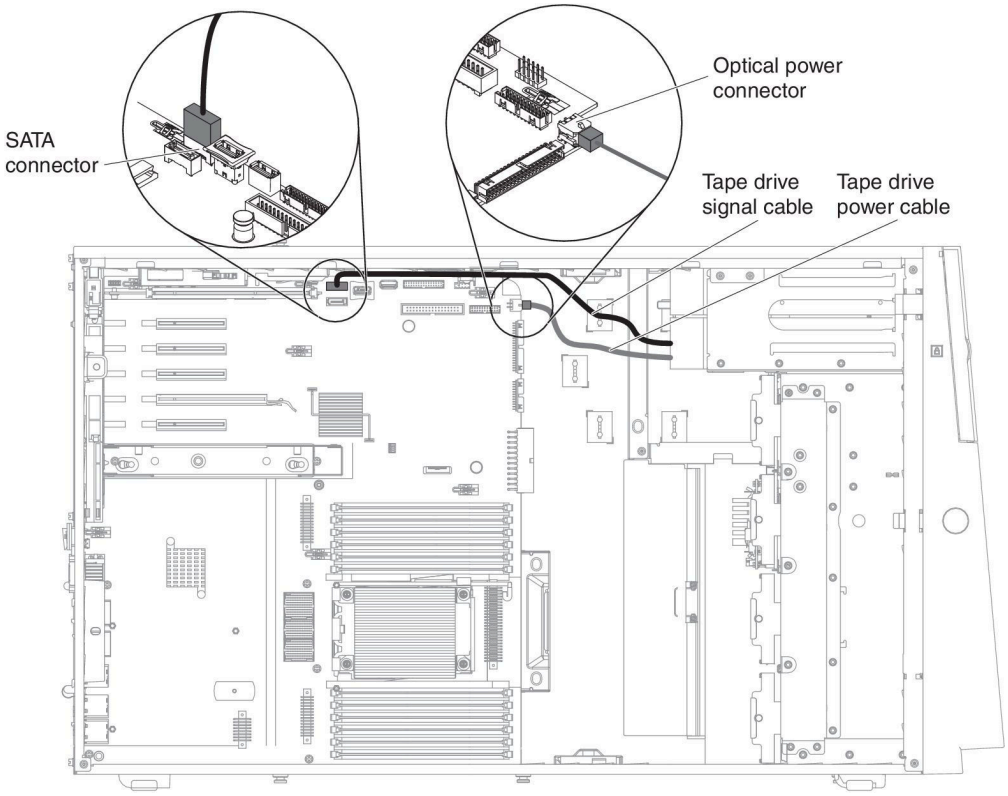


Tape drive cable connection

You can install either a USB or SATA tape drive in the server. The following illustration shows the internal cable routing and connectors for the USB tape drive. It also shows the internal power cable for the optical drives.

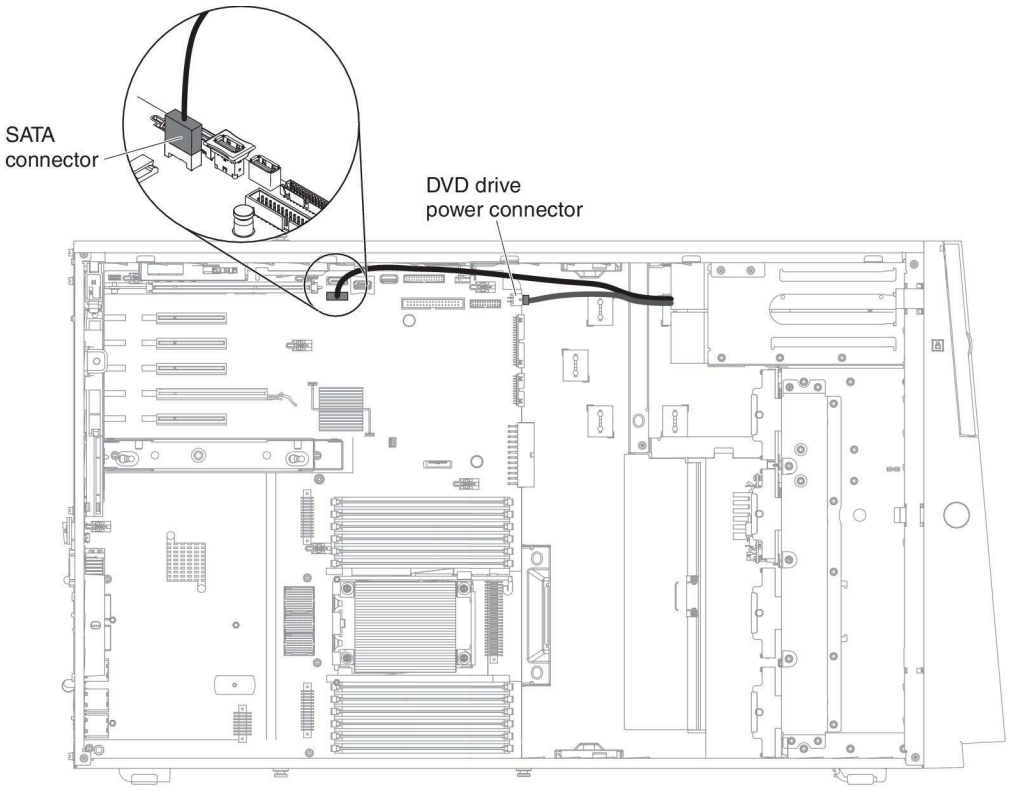


The following illustrations show the cable routing and connectors for the SATA tape drive. It also shows the internal power cable for the optical drives.



DVD drive cable connection

The following illustration shows the internal SATA and power cable routing and the connectors from the DVD drive to the system board.



Hard disk drive cable connection

Review the following information before connecting power and signal cables to internal drives:

1. The following illustrations show the connectors on the 2.5-inch and 3.5-inch hard disk drive backplanes.

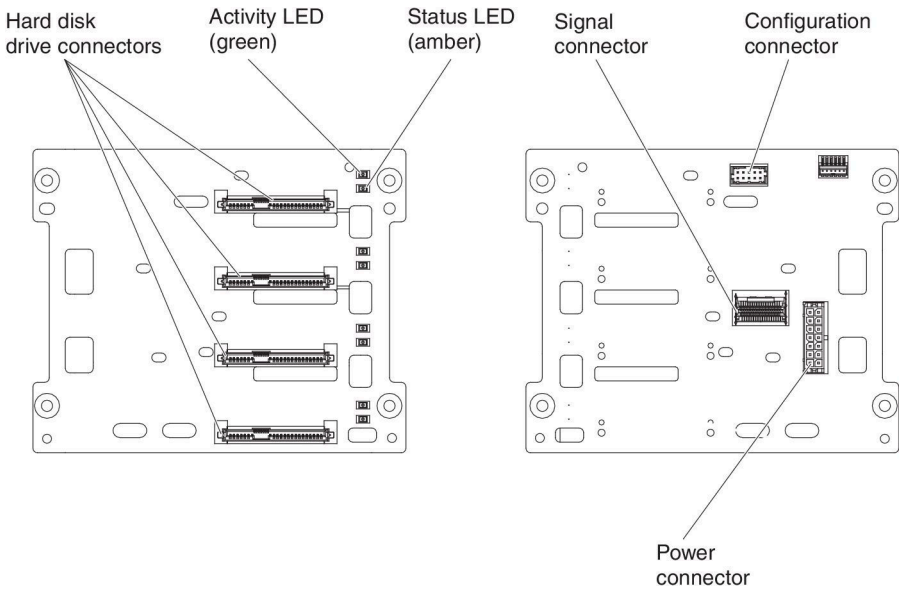


Figure 5. Connectors on the 3.5-inch hard disk drive backplane

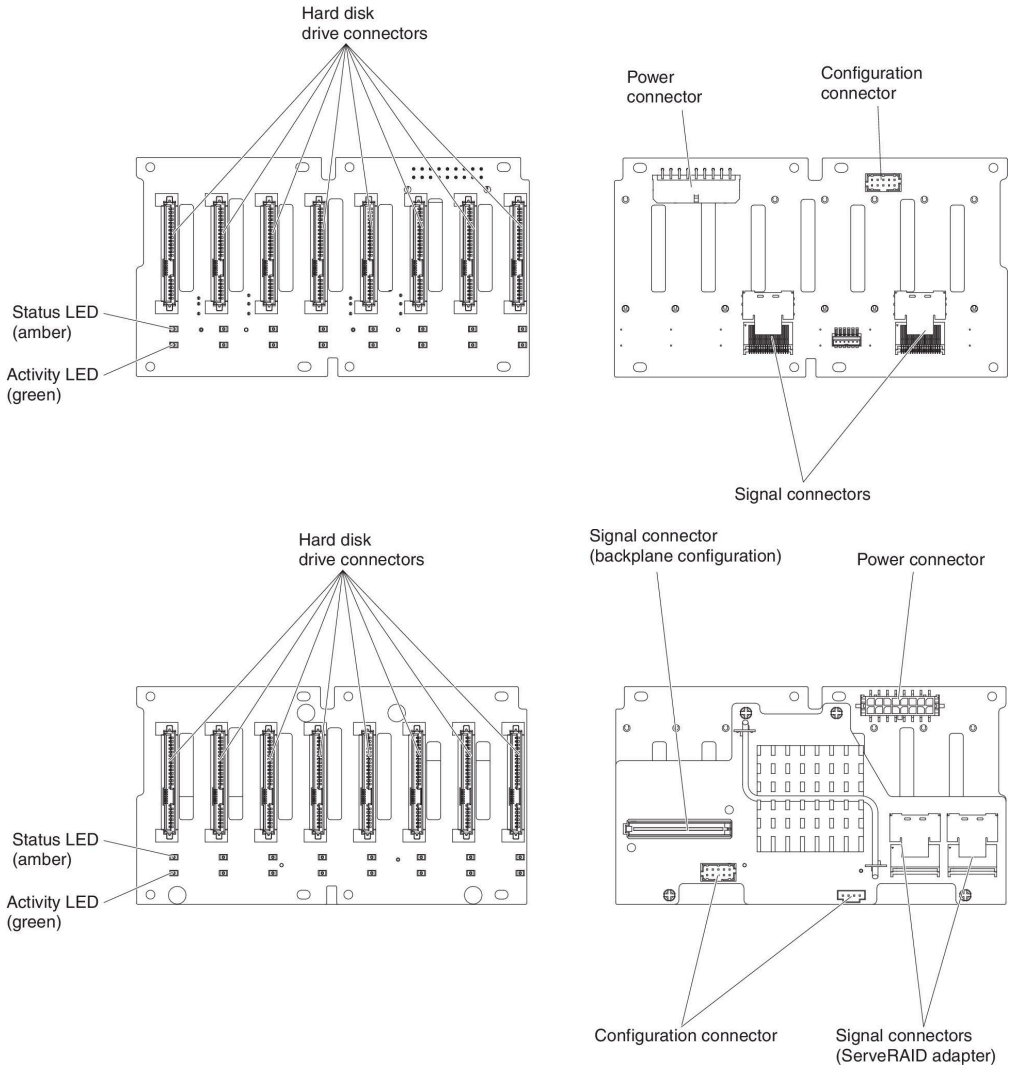
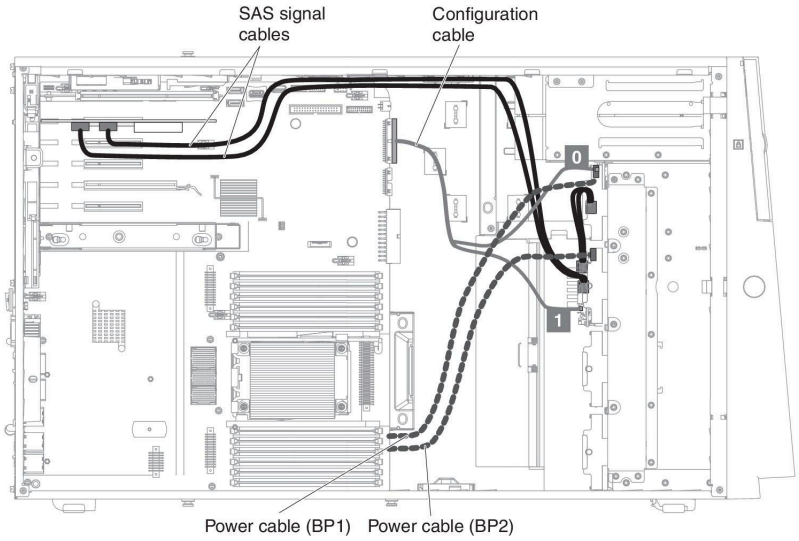


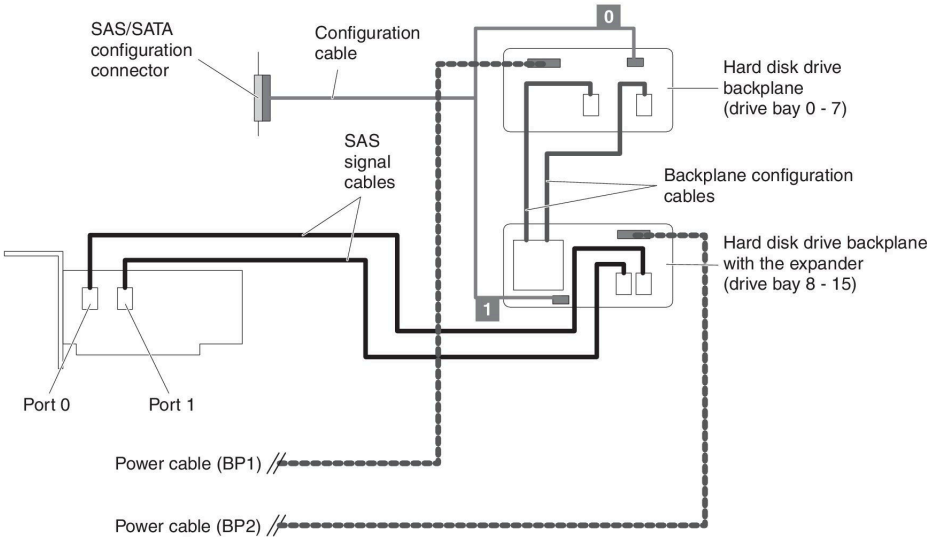
Figure 6. Connectors on the 2.5-inch hard disk drive backplane

Note: If the server is configured for RAID operation using a ServeRAID adapter, you might have to reconfigure your disk arrays after you install drives. See the ServeRAID adapter documentation for additional information about RAID operation and complete instructions for using the ServeRAID adapter.

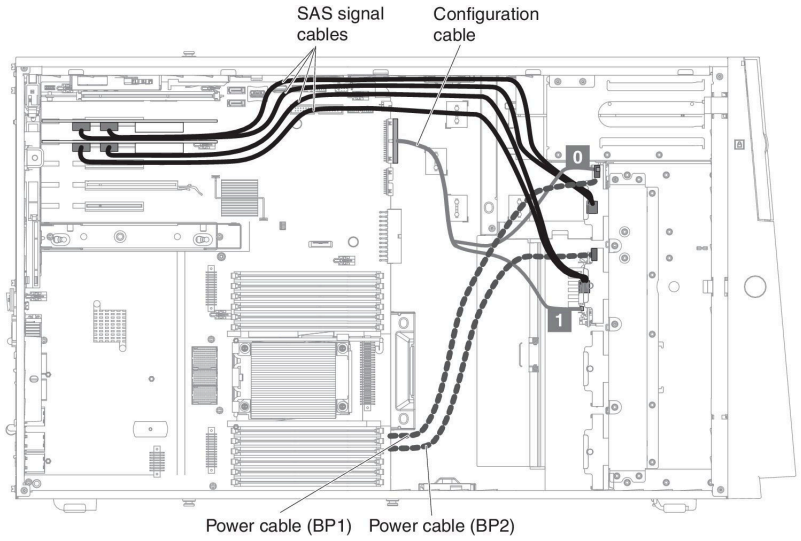
Review the following information before connecting cables to the backplanes:

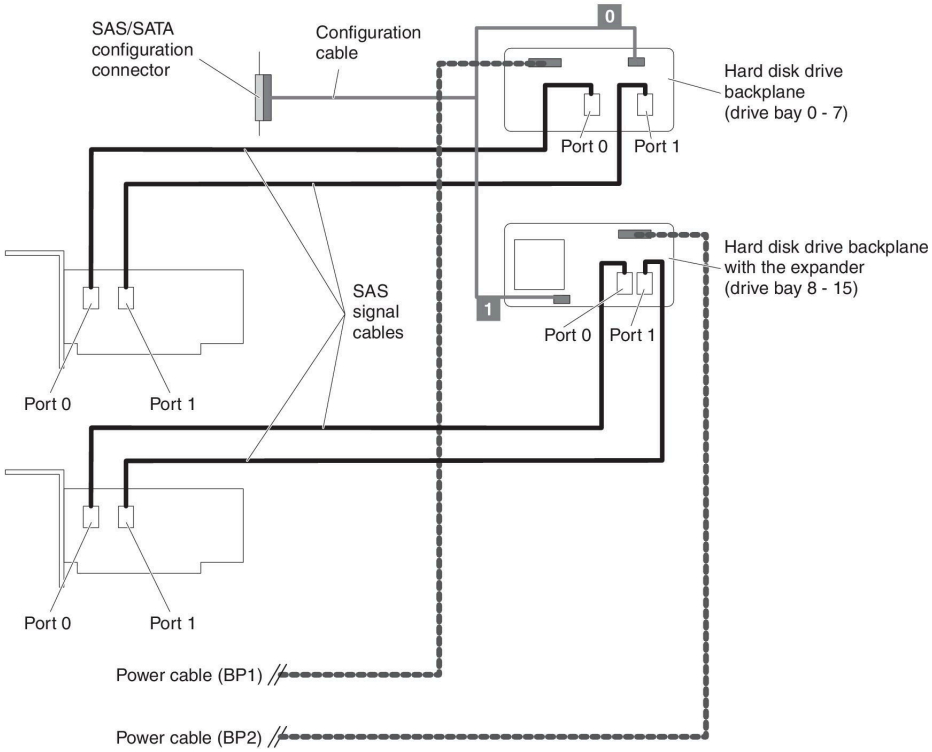
1. For server models with sixteen 2.5-inch hot-swap hard disk drives.



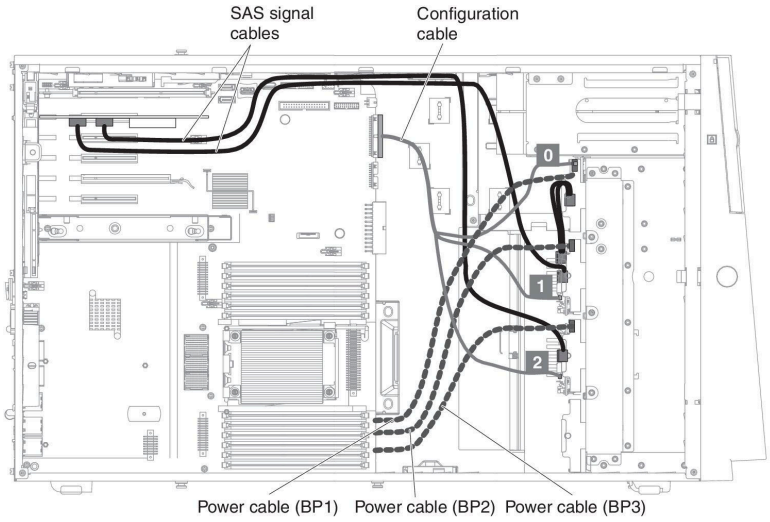


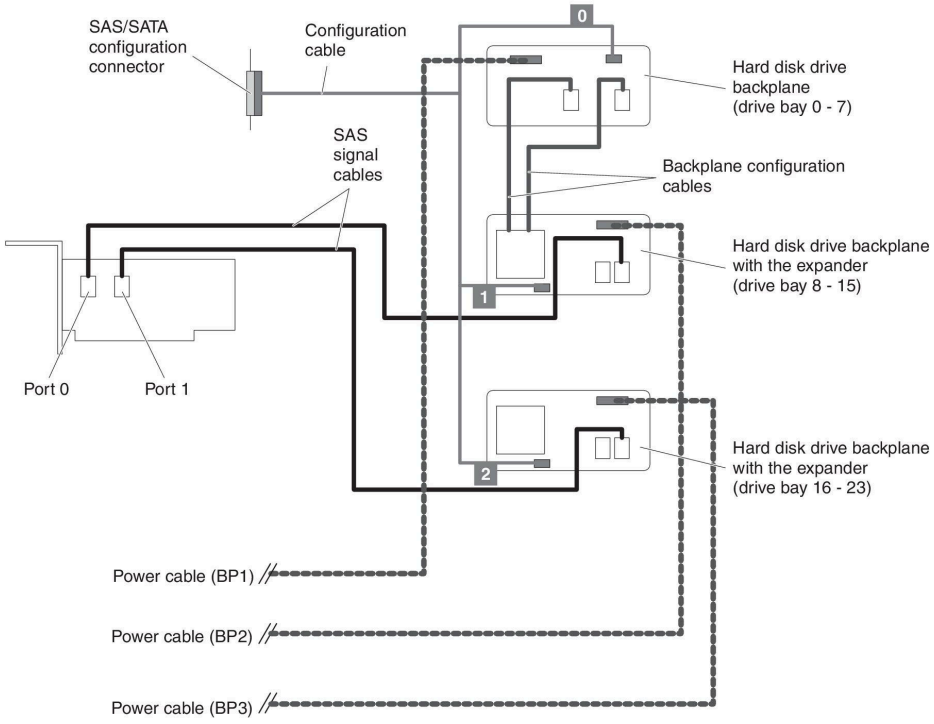
2. For server models with sixteen 2.5-inch hot-swap hard disk drives and two ServeRAID adapters.



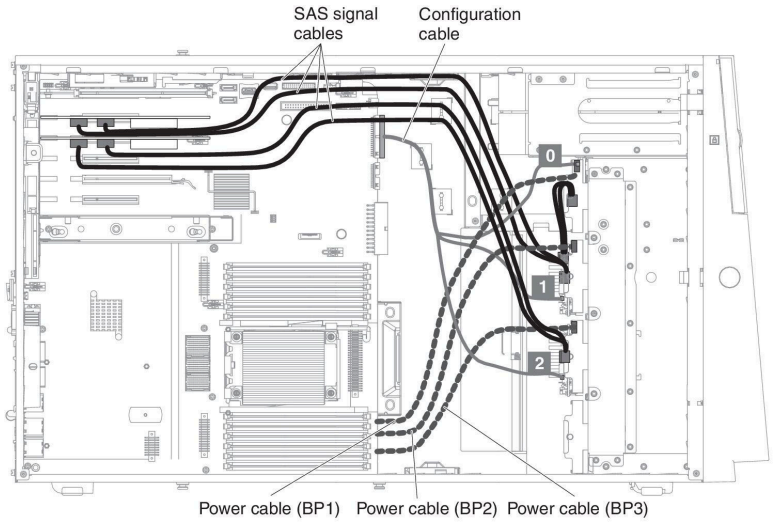


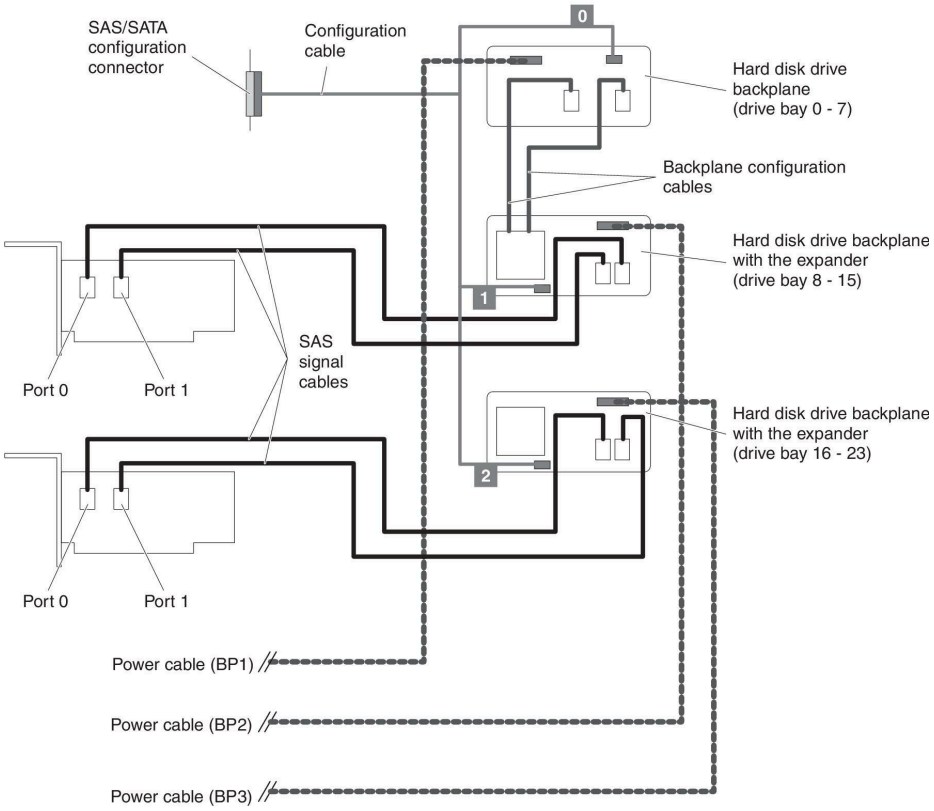
3. For server models with twenty-four 2.5-inch hot-swap hard disk drives.



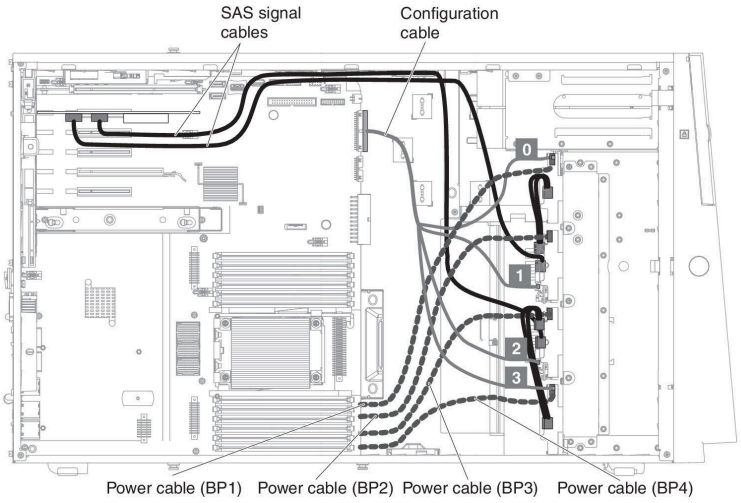

SAS/SATA configuration connector
Configuration cable
0
Hard disk drive backplane (drive bay 0 - 7)
SAS signal cables
Backplane configuration cables
Hard disk drive backplane with the expander (drive bay 8 - 15)
1
Port 0
Port 1
Hard disk drive backplane with the expander (drive bay 16 - 23)
2
Power cable (BP1)
Power cable (BP2)
Power cable (BP3)

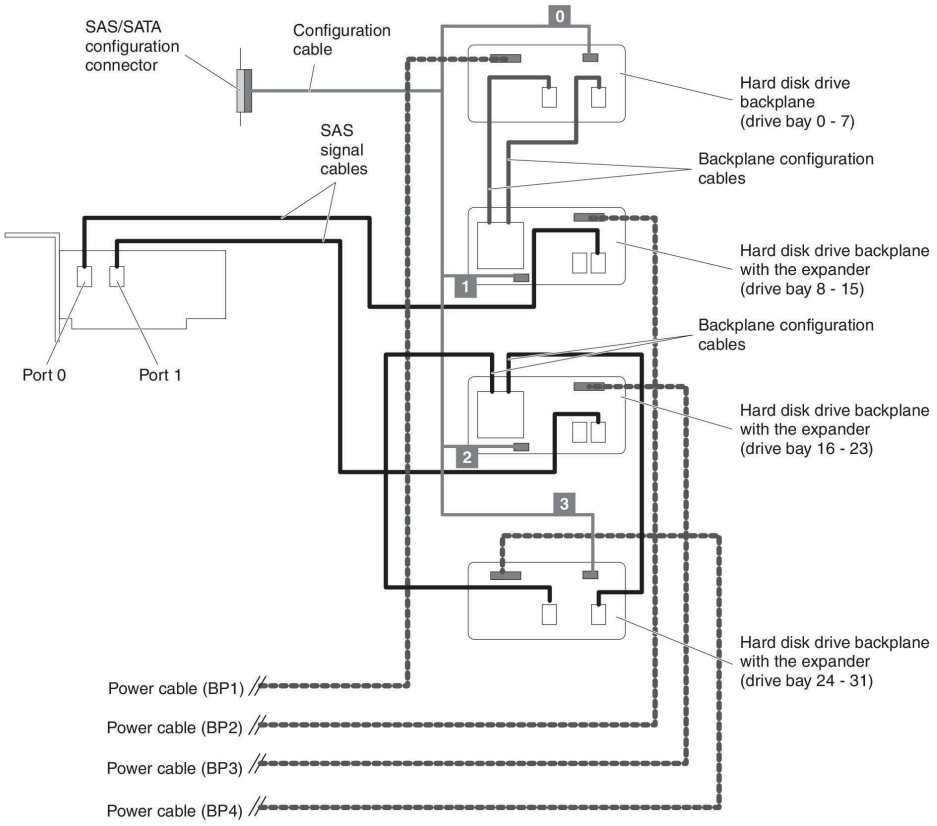
4. For server models with twenty-four 2.5-inch hot-swap hard disk drives and two ServeRAID adapters.



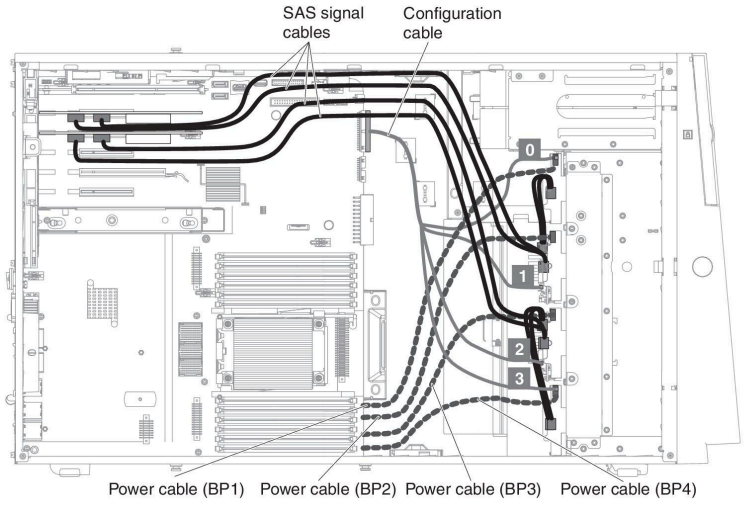


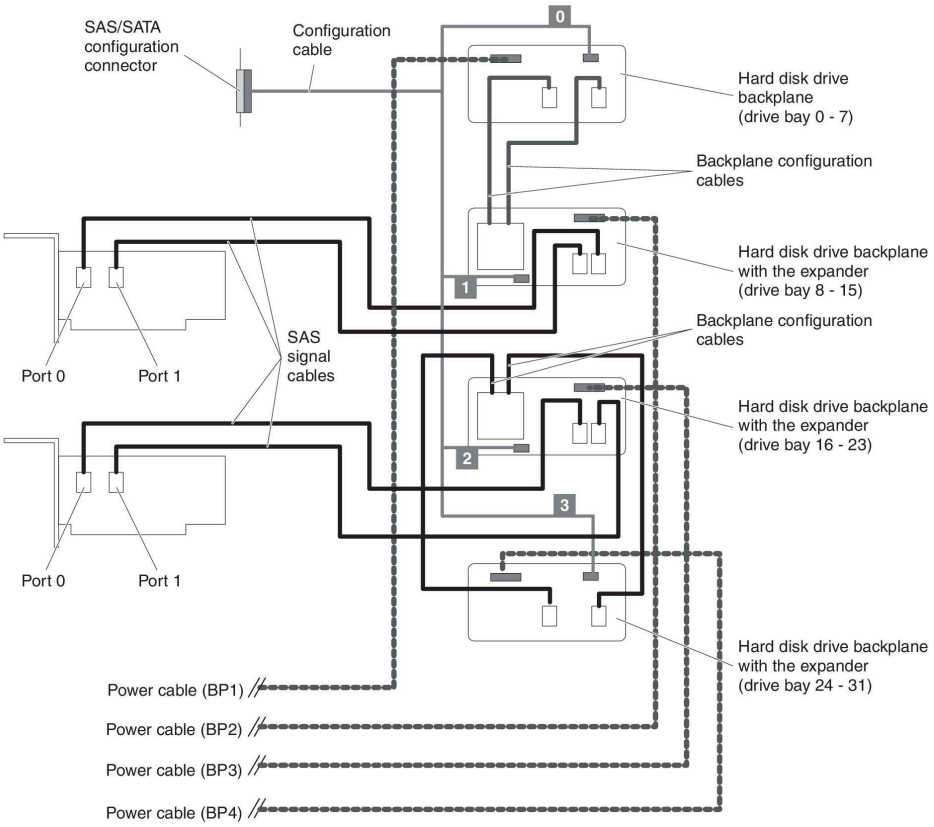
5. For server models with thirty-two 2.5-inch hot-swap hard disk drives.



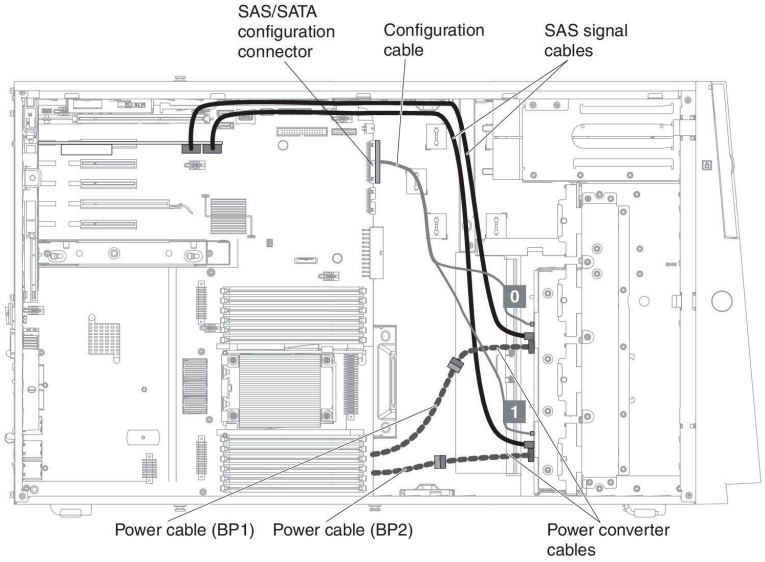

SAS/SATA configuration connector
Configuration cable
SAS signal cables
Port 0
Port 1
0
1
2
3
Hard disk drive backplane (drive bay 0 - 7)
Backplane configuration cables
Hard disk drive backplane with the expander (drive bay 8 - 15)
Backplane configuration cables
Hard disk drive backplane with the expander (drive bay 16 - 23)
Hard disk drive backplane with the expander (drive bay 24 - 31)
Power cable (BP1)
Power cable (BP2)
Power cable (BP3)
Power cable (BP4)

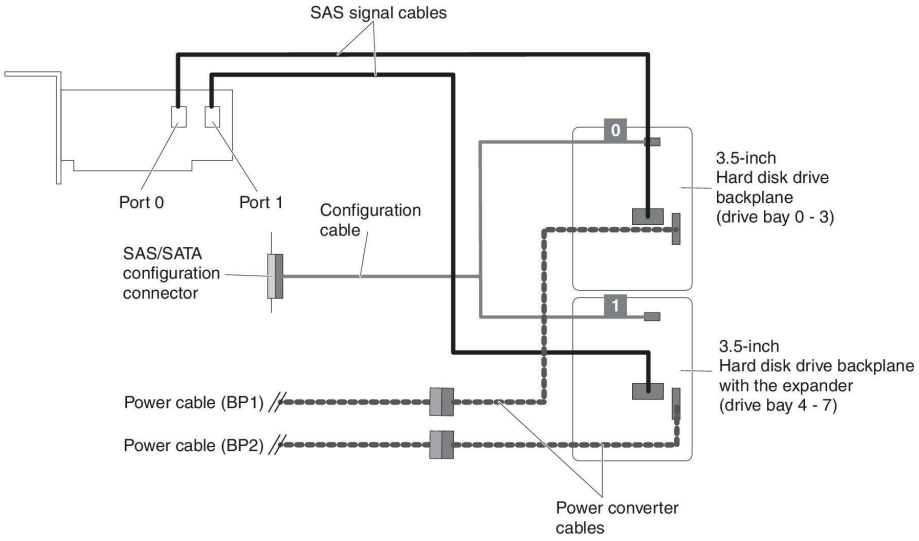
6. For server models with thirty-two 2.5-inch hot-swap hard disk drives and two ServeRAID adapters.



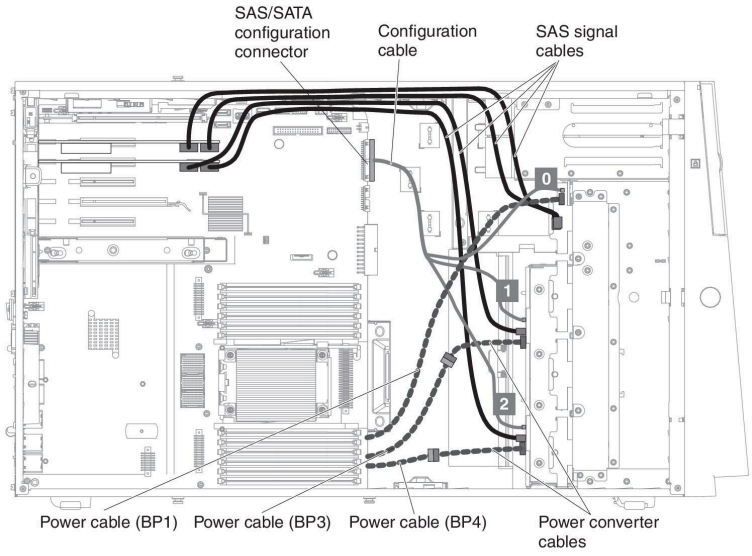

SAS/SATA configuration connector
Configuration cable
0
Hard disk drive backplane (drive bay 0 - 7)
Backplane configuration cables
Hard disk drive backplane with the expander (drive bay 8 - 15)
1
Backplane configuration cables
SAS signal cables
Port 0
Port 1
Hard disk drive backplane with the expander (drive bay 16 - 23)
2
3
Port 0
Port 1
Hard disk drive backplane with the expander (drive bay 24 - 31)
Power cable (BP1)
Power cable (BP2)
Power cable (BP3)
Power cable (BP4)

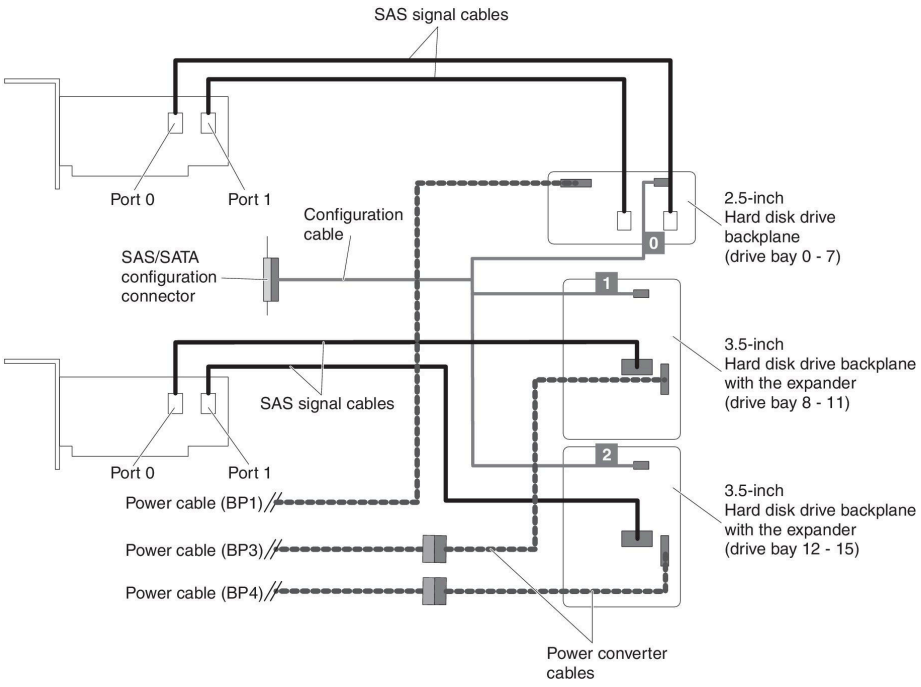
7. For server models with eight 3.5-inch hot-swap hard disk drives.



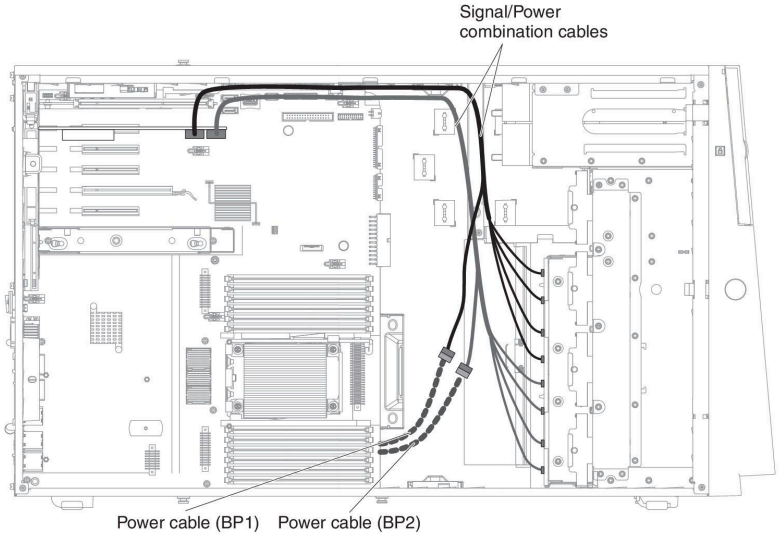


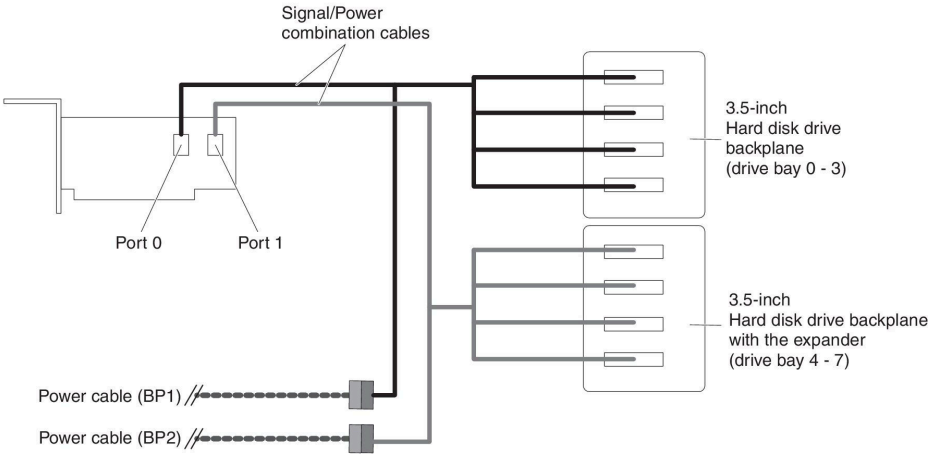
8. For server models with eight 2.5-inch hot-swap hard disk drives and eight 3.5-inch hot-swap hard disk drives.



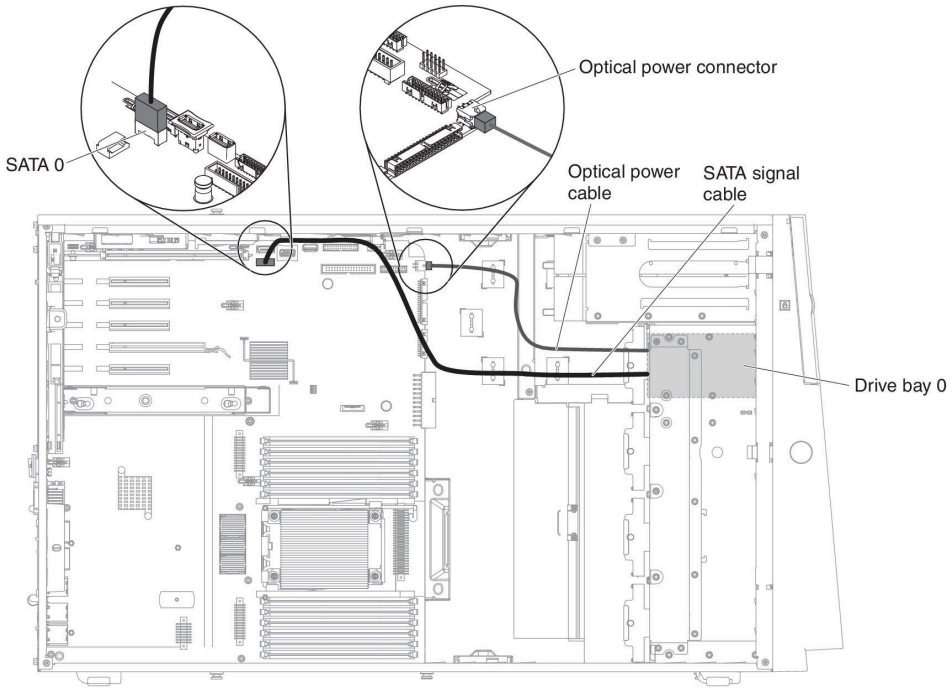


9. For server models with eight 3.5-inch simple-swap hard disk drives.



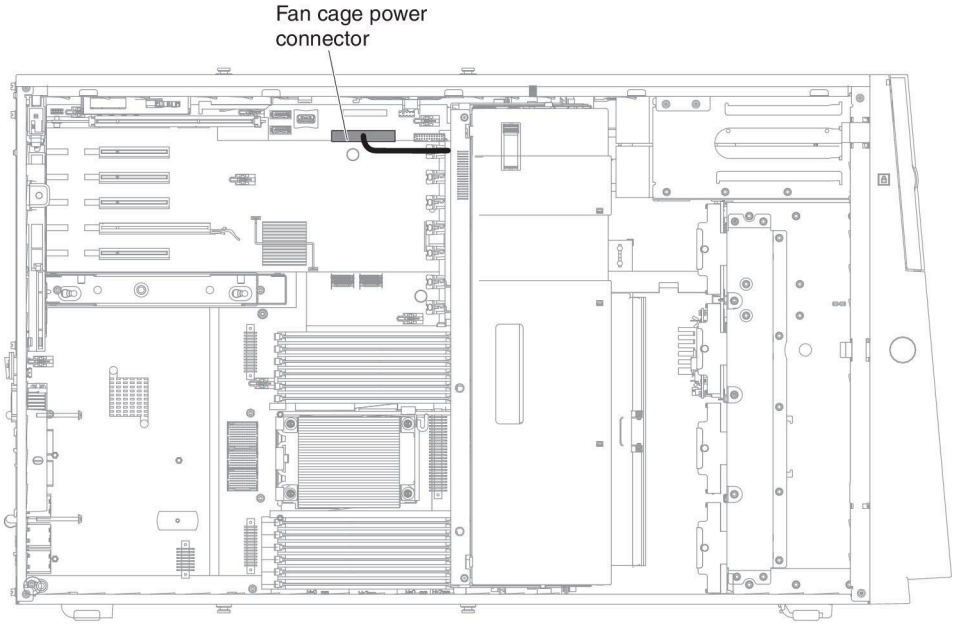


10. For server models with one 2.5-inch simple-swap hard disk drives.



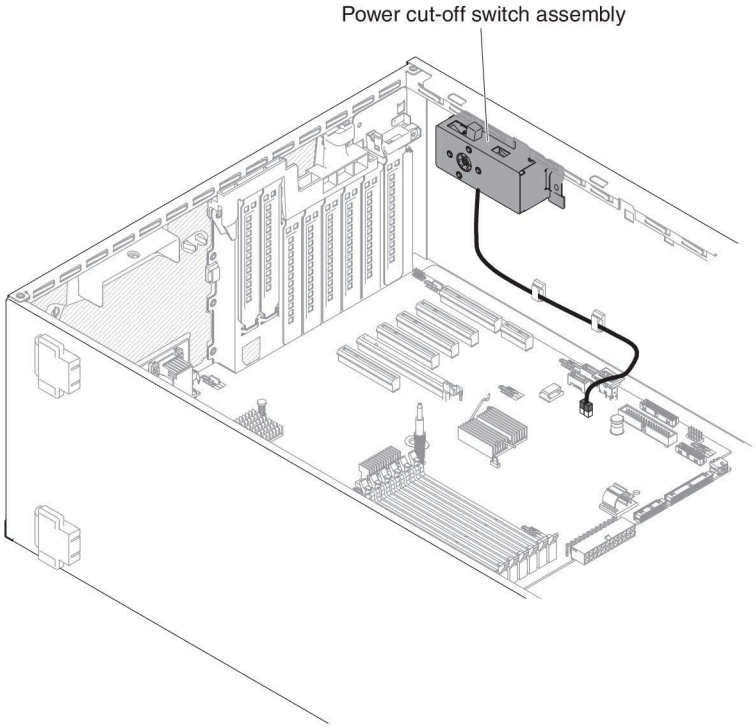
Fan cage power cable connection

The following illustration shows the internal cable routing and connectors from the fan cage assembly to the system board.



Left-side cover/power cut-off switch assembly cable connection

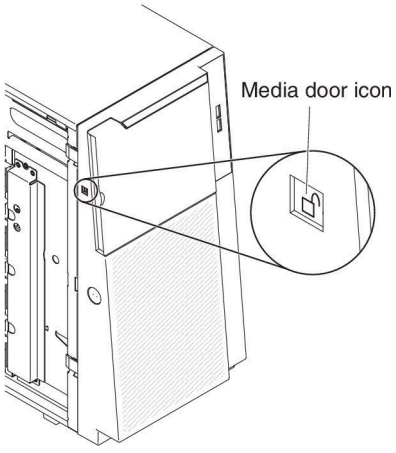
The following illustration shows the power cut-off switch assembly cable routing and the connector on the system board.



Opening the bezel media door

To open the media door, complete the following steps:

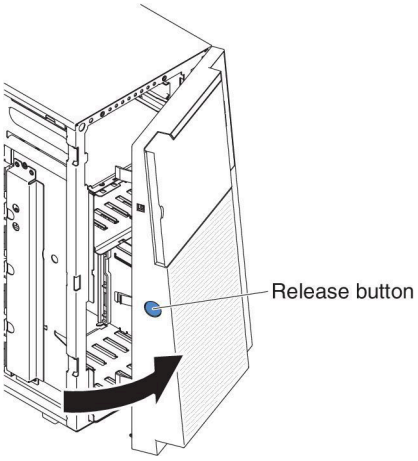
1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Check the status of the media door icon. If the icon on the side of the bezel is in the unlocked position, open the bezel media door directly.



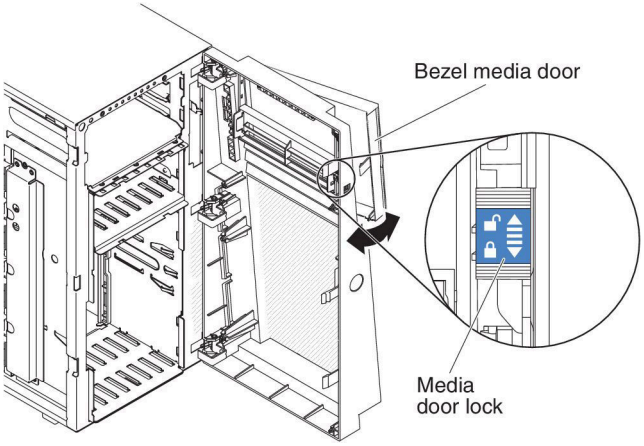
3. Unlock the left-side cover.

   Note: You must unlock the left-side cover to open or remove the bezel. When you lock the left-side cover, it locks both the cover and the bezel.

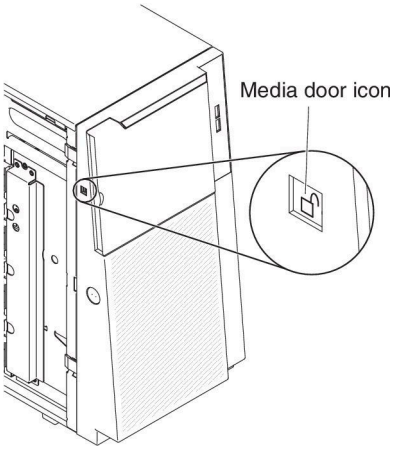
4. Open the bezel by pressing the button on the left edge of the bezel, and rotate the left side of the bezel away from the server.



5. From inside of the top section of the bezel door, slide the blue tab up to unlock the bezel media door; then, grasp the depressed area on the media door and pull the door open.



6. When the media door is unlocked, the icon on the side of the bezel will be in the unlocked position.



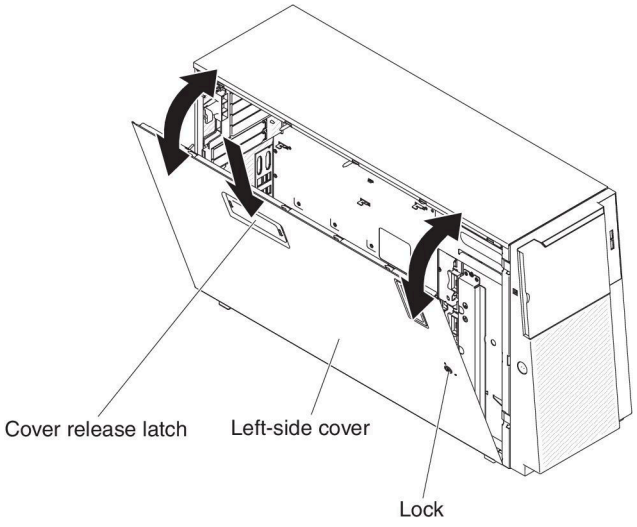
Removing the left-side cover

Important: Before you install optional hardware, make sure that the server is working correctly. Start the server, and make sure that the operating system starts, if an operating system is installed, or that a 19990305 error code is displayed, indicating that an operating system was not found but the server is otherwise working correctly. If the server is not working correctly, see the *Problem Determination and Service Guide* for diagnostic information.

Attention: The server automatically powers off when the left-side cover is removed.

To remove the left-side cover, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Turn off the server and peripheral devices and disconnect the power cords and all external cables, if necessary.
3. Unlock the left-side cover, using the key that comes with the server.
4. Pull the cover-release latch down while you rotate the top edge of the cover away from the server; then, lift the cover off the server.



Removing the air baffle

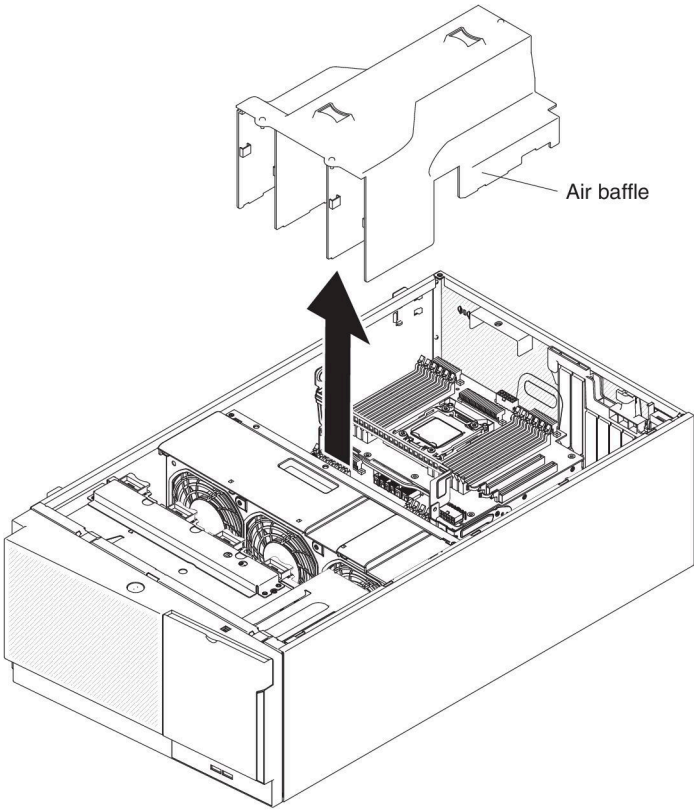
Note: When you install the second microprocessor, you must also install fan 2 and the air baffle that come with the second microprocessor upgrade kit.

To remove the air baffle, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables.
3. Carefully turn the server on its side so that it is lying flat, with the cover facing up.

   Attention: Do not allow the server to fall over.
4. Unlock and remove the left-side cover (see “Removing the left-side cover”).

5. Remove the air baffle from the server and set it aside.



Attention: For proper cooling and airflow, replace the air baffle before you turn on the server. Operating the server with the air baffle removed might damage server components when two microprocessors installed.

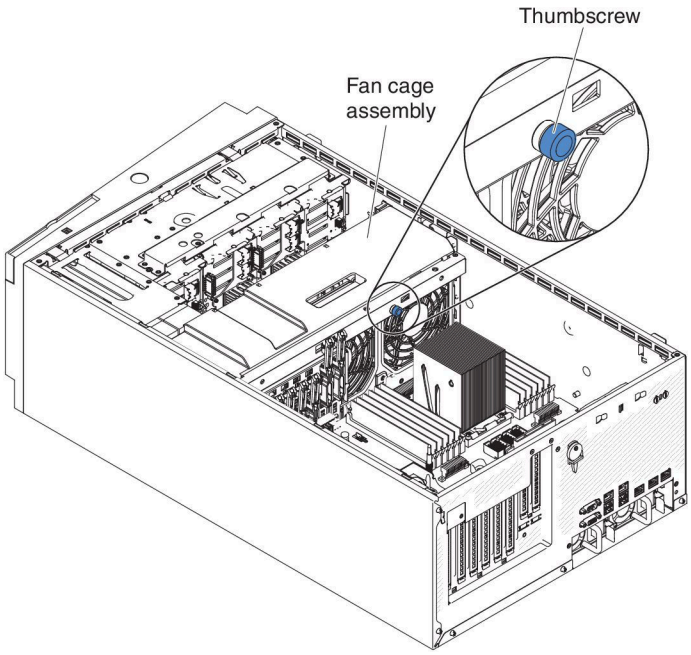
Removing the fan cage assembly

To remove the fan cage assembly, complete the following steps:

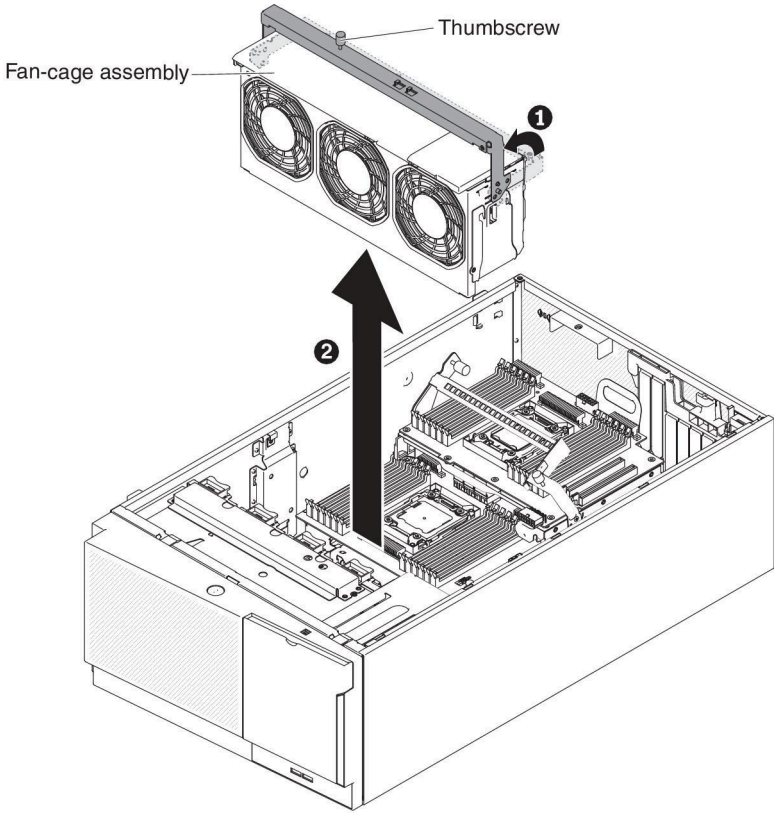
1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables.
3. Carefully turn the server on its side so that it is lying flat, with the cover facing up.

   Attention: Do not allow the server to fall over.
4. Unlock and remove the left-side cover (see “Removing the left-side cover” on page 60).
5. Remove the air baffle (see “Removing the air baffle” on page 60).
6. Remove all long cards from the system board.
7. Disconnect the fan cage power cable from the system board (see “Internal cable routing and connectors” on page 40).

8. Loosen the thumb screw on the fan cage release latch.



9. Rotate the fan cage release latch to the open position. The fan cage will lift up slightly when the release latch is fully open.



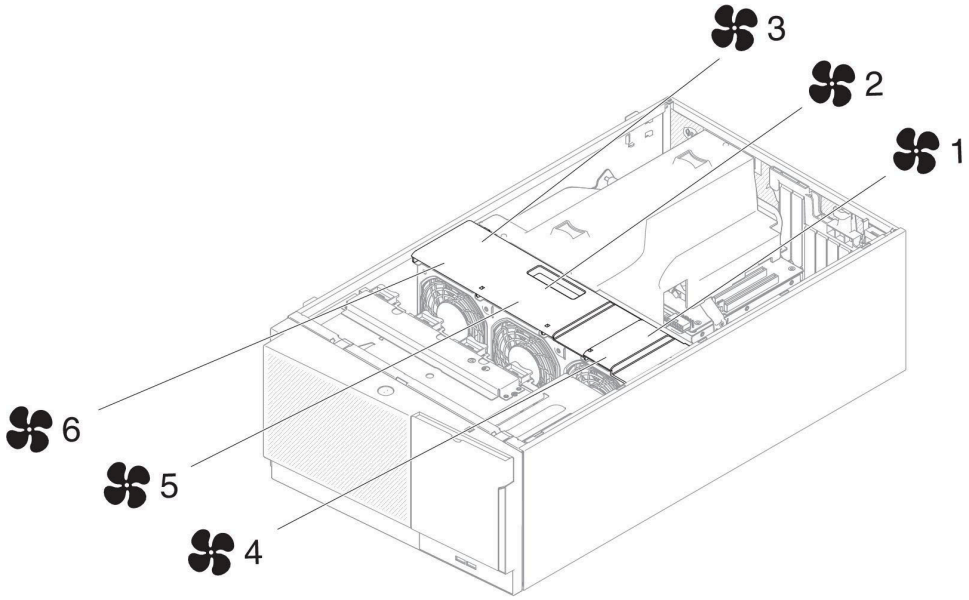
10. Grasp the fan cage assembly and lift it out of the server.

Installing a simple-swap fan

The server comes with two 120 mm x 38 mm simple-swap fans in the fan cage assembly. The following instructions can be used to install any simple-swap fan in the server.

Notes:

1. When you install the second microprocessor, you must also install fan 2 and the air baffle that come with the second microprocessor upgrade kit. The fan filler can only be removed when fan 2 is installed. Otherwise, the fan filler must be installed for proper cooling.

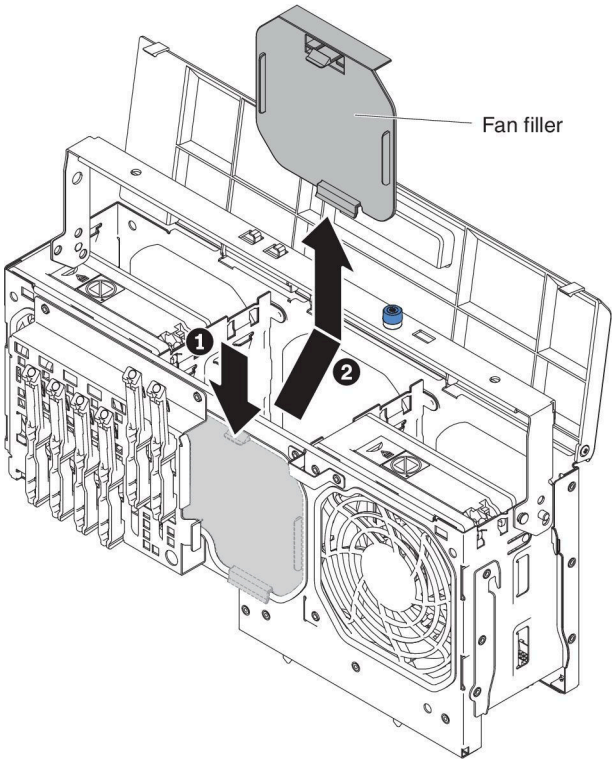


2. You can order the three additional fans for redundant cooling.

To install a simple-swap fan, complete the following steps:

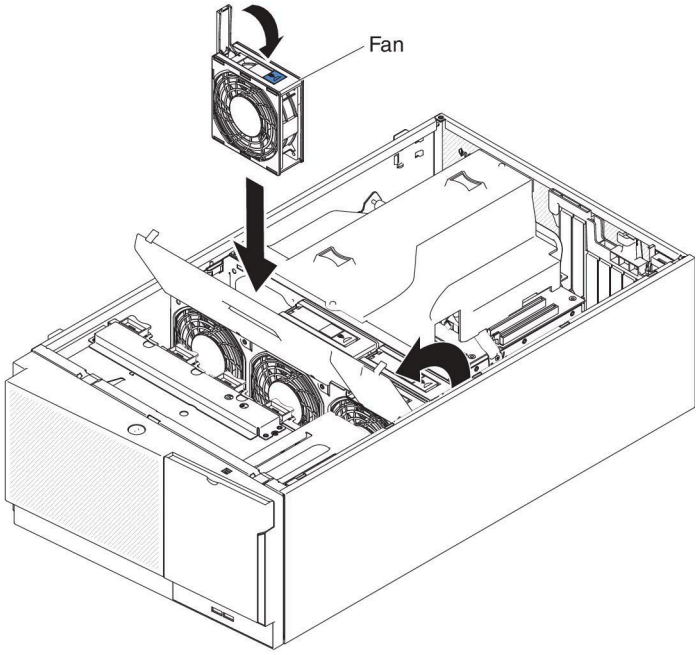
1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.

   Attention: Static electricity that is released to internal server components when the server is powered-on might cause the server to halt, which might result in the loss of data. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding system when you work inside the server with the power on.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables.
3. Touch the static-protective package that contains the simple-swap fan to any unpainted metal surface on the server; then, remove the fan from the package.
4. Unlock and remove the left-side cover (see “Removing the left-side cover” on page 60).
5. Open the fan cage cover.
6. Perform the following steps only if you want to install the simple swap fan in the Fan 2 compartment:
   a. Unfasten and open the release lever (see “Removing the fan cage assembly” on page 61).
   b. Press and release the clip on the fan filler to remove the fan filler from the server.



c. Close and fasten the release lever.

7. Open the fan-locking handle on the replacement fan.
8. Insert the fan into the socket and close the handle to the locked position.



9. Close the fan cage cover.
10. Install and lock the left-side cover (see “Replacing the left-side cover” on page 113).

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 109.

Installing drives

Depending on the server model, the server might come with a SATA attached DVD-ROM drive in bay 1.

The followings are illustrations of the server and the location of the drive bays. Your hardware might differ, depending on the model.

Note: If the server is configured for RAID operation using a ServeRAID adapter, you might have to reconfigure your disk arrays after you install drives. See the ServeRAID adapter documentation for additional information about RAID operation and complete instructions for using the ServeRAID adapter.

The following illustrations show the location of the drive bays in the 2.5-inch hot-swap SAS or hot-swap SATA hard disk drive server models.

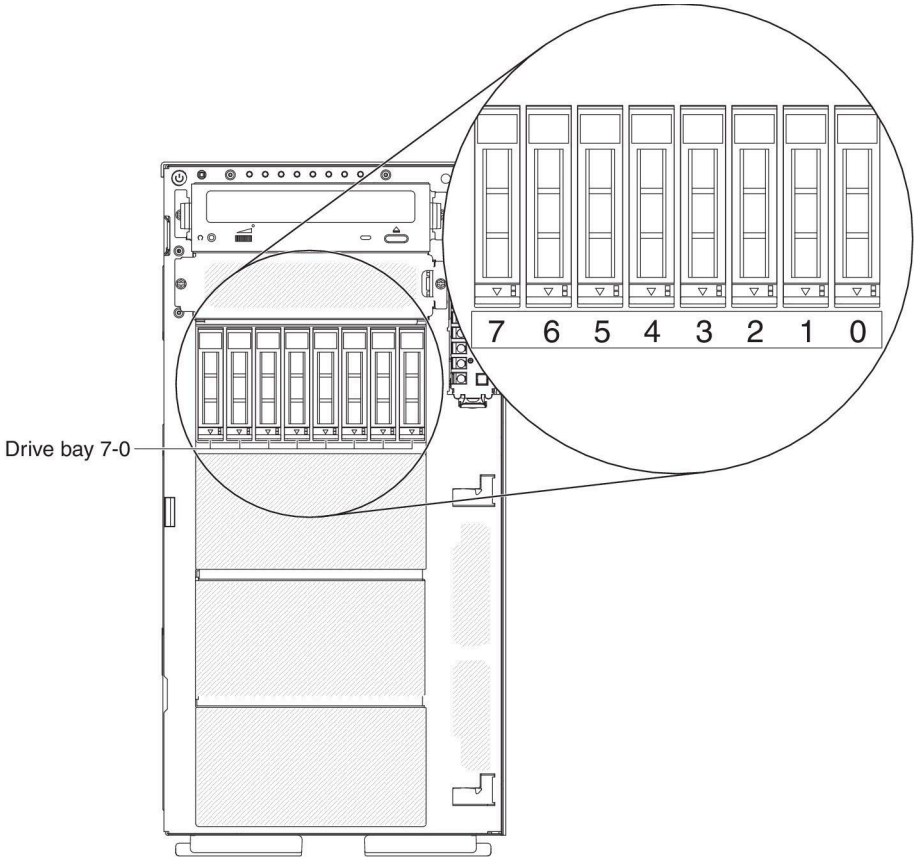


Figure 7. server with eight 2.5-inch hard disk drives

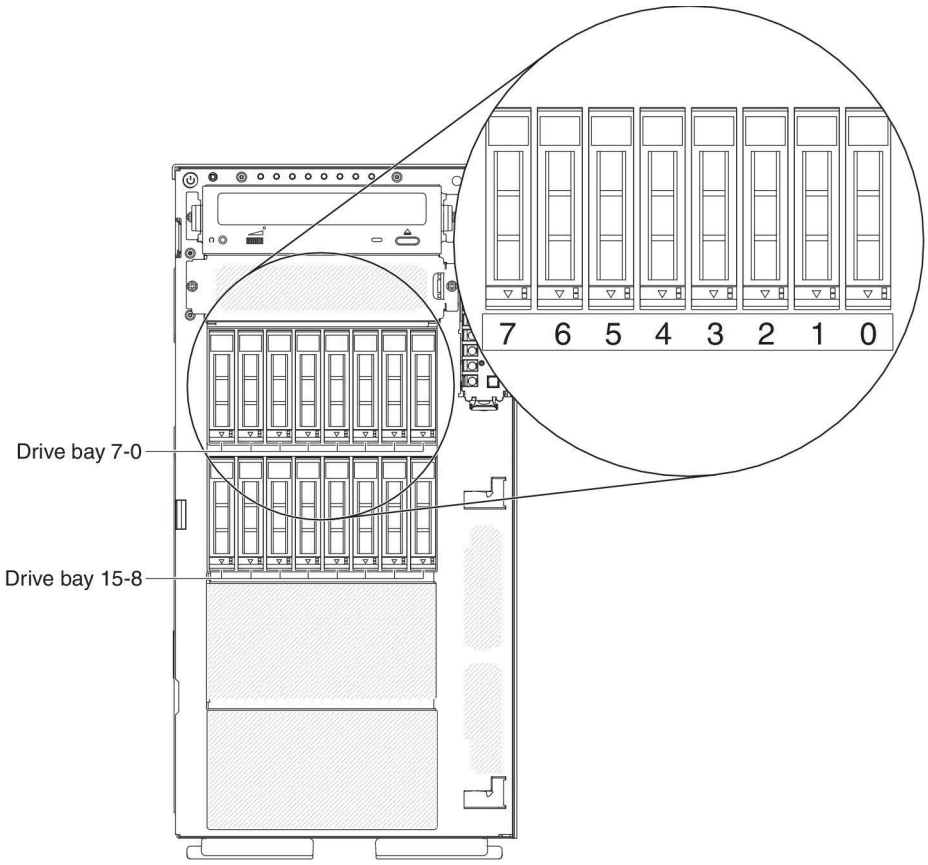


Figure 8. Server with sixteen 2.5-inch hard disk drives

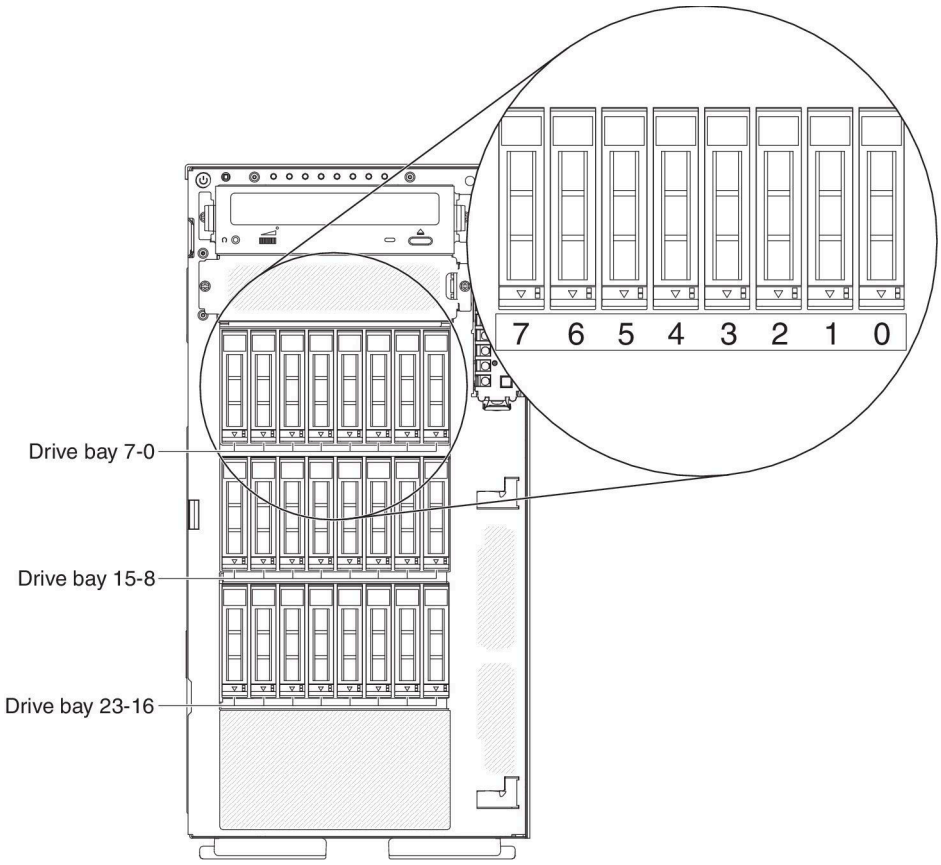


Figure 9. server with twenty-four 2.5-inch hard disk drives

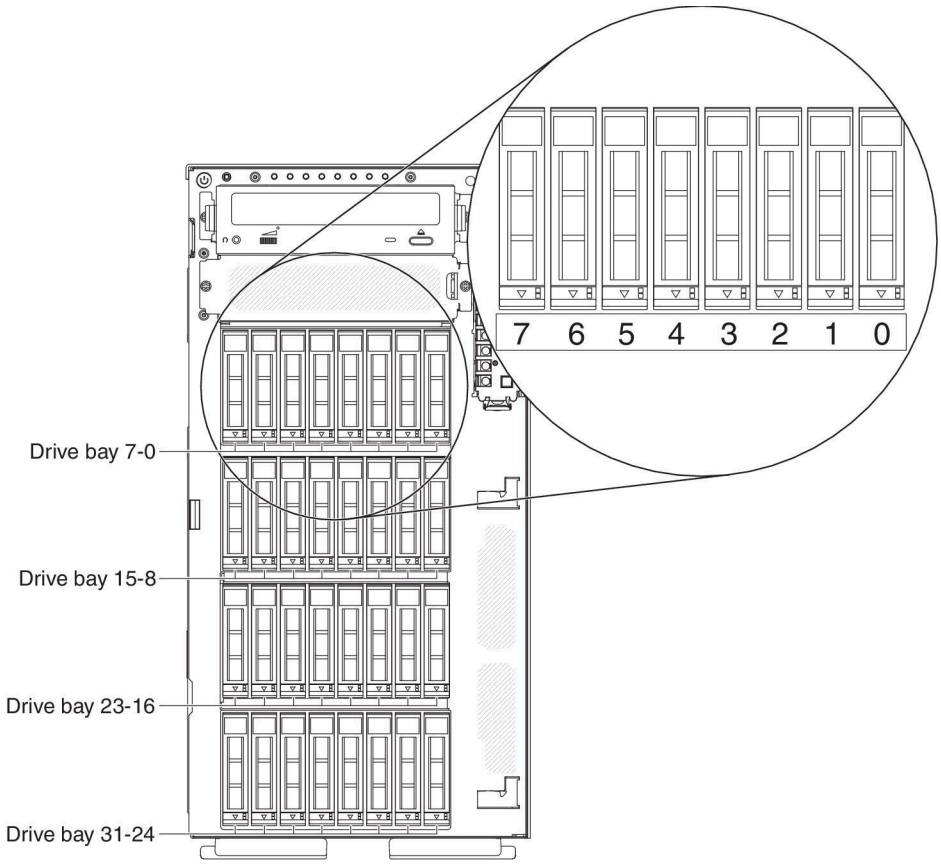


Figure 10. Server with thirty-two 2.5-inch hard disk drives

The following illustrations show the location of the drive bays in the 3.5-inch hot-swap SAS or hot-swap SATA hard disk drive server models.

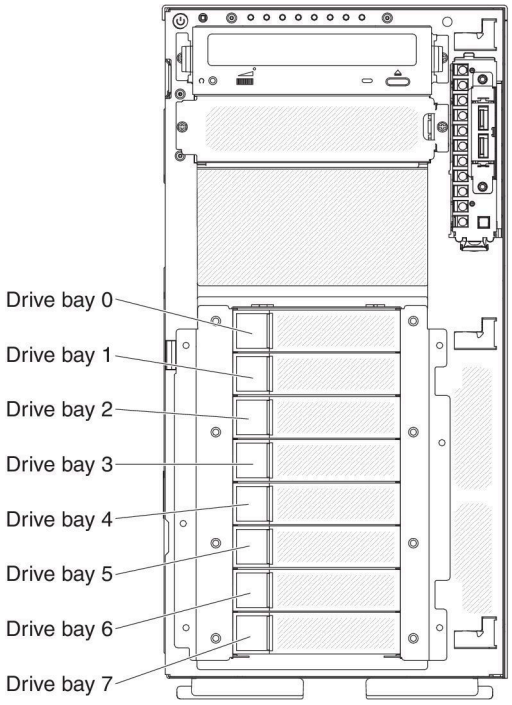


Figure 11. Server with eight 3.5-inch hard disk drives

The following illustrations show the location of the drive bays in the 2.5-inch and 3.5-inch hot-swap SAS or hot-swap SATA hard disk drive server models.

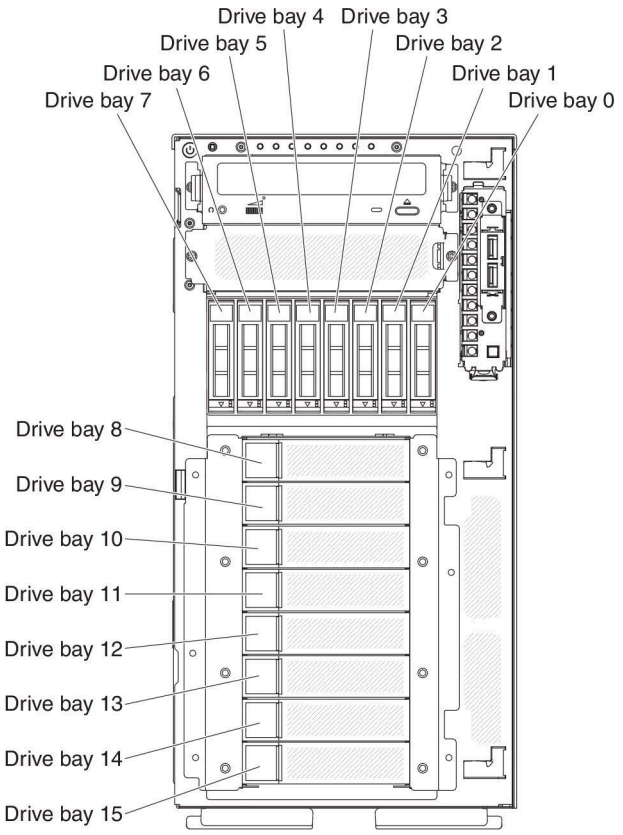


Figure 12. Server with eight 2.5-inch hard disk drives and eight 3.5-inch hard disk drives

The following notes describe the types of drives that the server supports and other information that you must consider when installing a drive:

- Make sure that you have all the cables and other equipment that is specified in the documentation that comes with the drive.
- Check the instructions that come with the drive to see whether you have to set any switches or jumpers on the drive. If you are installing a SAS or SATA device, be sure to set the SAS or SATA ID for that device.
- Optional external tape drives and DVD-ROM drives are examples of removable-media drives. You can install removable-media drives only in bays 1 and 2 on models with eight 3.5-inch, eight, sixteen, twenty-four, and thirty-two 2.5-inch hard disk drives.
- The electromagnetic interference (EMI) integrity and cooling of the server are protected by having all bays and PCI slots covered or occupied. When you install a drive or PCI adapter, save the EMC shield and filler panel from the bay or the PCI adapter slot cover in the event that you later remove the drive or adapter.
- For a complete list of supported options for the server, see http://www.ibm.com/servers/eserver/serverproven/compat/us/.

Installing a 2.5-inch hot-swap hard disk drive

The following notes describe the types of hard disk drives that the server supports and other information that you must consider when you install a hard disk drive:

- Depending on the model, the server supports up to eight or up to thirty-two 2.5-inch SAS/SATA hot-swap hard disk drives in the hot-swap bays.

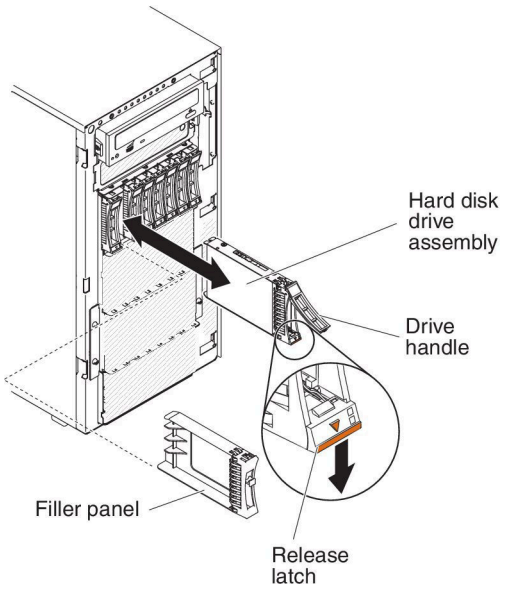
  Note: When using ServeRAID adapter M1015 to support more than sixteen 2.5-inch hard disk drives, the maximum number of RAID supported drives is 16. All the other drives will remain JBOD (the drives are presented to the operating system without a RAID configuration).
- For a list of supported optional devices for the server, see http://www.ibm.com/servers/eserver/serverproven/compat/us/.
- Inspect the drive and drive bay for signs of damage.
- Make sure that the drive is correctly installed in the drive bay.
- See the documentation for the ServeRAID adapter for instructions for installing a hard disk drive.
- All hot-swap drives in the server must have the same throughput speed rating; using drives with different speed ratings might cause all drives to operate at the speed of the slowest drive.
- You do not have to turn off the server to install hot-swap drives in the hot-swap drive bays. However, you must turn off the server when you perform any steps that involve installing or removing cables.

To install a hot-swap hard disk drive, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.

   Attention: Static electricity that is released to internal server components when the server is powered-on might cause the server to halt, which might result in the loss of data. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding system when you work inside the server with the power on.
2. Unlock the left-side cover.

   Note: You must unlock the left-side cover to open or remove the bezel. When you lock the left-side cover, it locks both the cover and the bezel.
3. Open the bezel (see “Opening the bezel media door” on page 58).
4. Remove the filler panel, if one is present.
5. Touch the static-protective package that contains the disk drive to any unpainted metal surface on the server; then, remove the disk drive from the package.
6. Make sure that the tray handle is open; then, install the hard disk drive into the hot-swap bay.
7. Rotate the drive handle down until the drive is seated in the hot-swap bay and the release latch clicks into place.



Notes:

a. After you install the hard disk drive, check the disk drive status LEDs to verify that the hard disk drive is operating correctly.

   If the yellow hard disk drive status LED is lit continuously, that drive is faulty and must be replaced. If the green hard disk drive activity LED is flashing, the drive is being accessed.

b. If the server is configured for RAID operation through an optional ServeRAID adapter, you might have to reconfigure your disk arrays after you install hard disk drives. See the ServeRAID documentation on the *IBM ServeRAID Support* CD for additional information about RAID operation and complete instructions for using ServeRAID Manager.

8. Close the bezel.
9. Lock the left-side cover.

Installing a 3.5-inch hot-swap hard disk drive

Before installing a 3.5-inch hot-swap hard disk drive, read the following information:

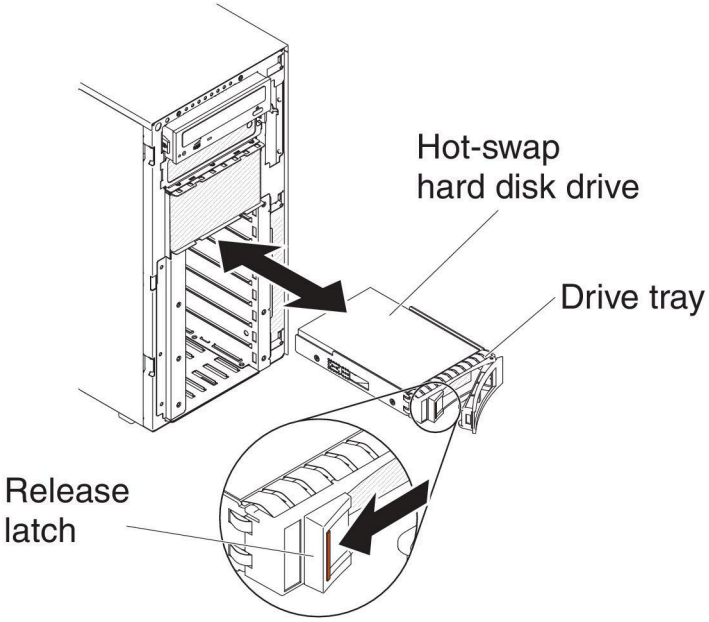
- Inspect the drive tray for signs of damage.
- To maintain proper system cooling, do not operate the server for more than 10 minutes without either a drive or a filler panel installed in each drive bay.
- You do not have to turn off the server to install hot-swap drives in the hot-swap drive bays.

To install a 3.5-inch hot-swap hard disk drive, complete the following steps.

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Unlock the left-side cover.

   Note: You must unlock the left-side cover to open or remove the bezel. When you lock the left-side cover, it locks both the cover and the bezel.
3. Open the bezel (see “Opening the bezel media door” on page 58).
4. Remove the filler panel, if one is present.

5. Touch the static-protective package that contains the drive to any unpainted metal surface on the server; then, remove the drive from the package and place it on a static-protective surface.
6. Make sure that the drive tray handle is in the open position.
7. Align the drive assembly with the guide rails in the bay; then, carefully slide the drive assembly into the drive bay until the drive snaps into place.



8. Rotate the drive tray handle to the closed position.
9. Check the hard disk drive status indicator to make sure that the hard disk drive is operating correctly.

   After you replace a failed hard disk drive, the green activity LED flashes as the disk spins up. The yellow LED turns off after approximately 1 minute. If the new drive starts to rebuild, the yellow LED flashes slowly, and the green activity LED remains lit during the rebuild process. If the yellow LED remains lit, see the *Problem Determination and Service Guide* for more information.

   Note: You might have to reconfigure the disk arrays after you install hard disk drives. See the RAID documentation on the IBM website at http://www.ibm.com/systems/support/ for information about RAID adapters.

If you have other devices to install or remove, do so now. Otherwise, go to "Completing the installation" on page 109.

Installing a 3.5-inch simple-swap hard disk drive

Before installing a 3.5-inch simple-swap hard disk drive, read the following information:

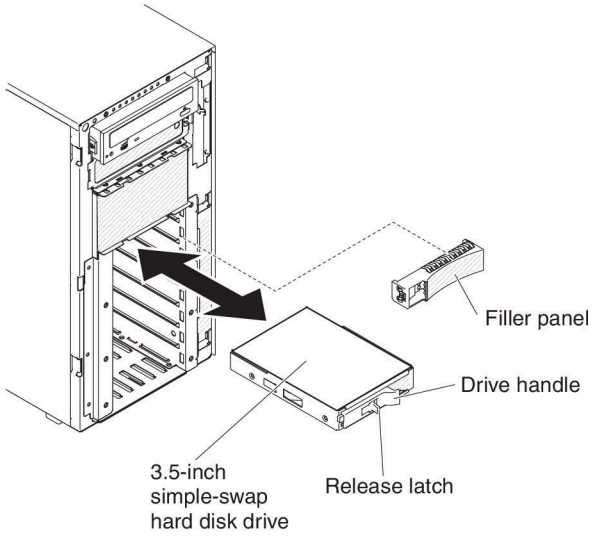
- Inspect the drive tray for signs of damage.
- To maintain proper system cooling, do not operate the server for more than 10 minutes without either a drive or a filler panel installed in each drive bay.

To install a 3.5-inch simple-swap hard disk drive, complete the following steps.

1. Read the safety information that begins on page vii and "Installation guidelines" on page 37.

2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables.
3. Unlock the left-side cover.

   Note: You must unlock the left-side cover to open or remove the bezel. When you lock the left-side cover, it locks both the cover and the bezel.
4. Open the bezel (see “Opening the bezel media door” on page 58).
5. Remove the filler panel, if one is present.
6. Touch the static-protective package that contains the drive to any unpainted metal surface on the server; then, remove the drive from the package and place it on a static-protective surface.
7. Grasp the black drive handle and slide the blue release latch to the right and align the drive assembly with the guide rails in the bay.



8. Gently push the drive into the bay until the drive stops.

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 109.

Installing a DVD drive

To install the DVD drive, complete the following steps:

1. If you are replacing a drive, make sure that:
   - You have all the cables and other equipment that are specified in the documentation that comes with the new drive.
   - You have checked the instructions that come with the new drive to determine whether you must set any switches or jumpers in the drive.
   - You have removed the blue optical drive rails from the side of the old drive and have them available for installation on the new drive.

   Note: If you are installing a drive that contains a laser, observe the following safety precautions.

   Statement 3:

CAUTION:
When laser products (such as CD-ROMs, DVD drives, fiber optic devices, or transmitters) are installed, note the following:

- **Do not remove the covers. Removing the covers of the laser product could result in exposure to hazardous laser radiation. There are no serviceable parts inside the device.**
- **Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.**

DANGER

Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

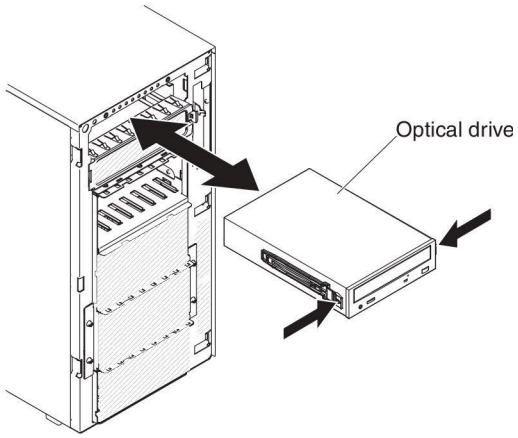
Class 1 Laser Product
Laser Klasse 1
Laser Klass 1
Luokan 1 Laserlaite
Appareil À Laser de Classe 1

2. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
3. Turn off the server and peripheral devices, and disconnect the power cords and all external cables.
4. Unlock and remove the left-side cover (see “Removing the left-side cover” on page 60).
5. Open the bezel (see “Opening the bezel media door” on page 58).
6. Remove the air baffle if installed (see “Removing the air baffle” on page 60).
7. Remove the fan cage assembly (see “Removing the fan cage assembly” on page 61).
8. Touch the static-protective package that contains the DVD drive to any unpainted metal surface on the server; then, remove the DVD drive from the package.
9. Install the blue rails on the DVD drive, using the holes nearest the center of the drive.

10. Follow the instructions that come with the drive to set jumpers or switches, if there is any.

    Note: You might find it easier to install the new drive from the front and then attach the cables.

11. Align the rails on the DVD drive with the guides in the drive bay; then, slide the DVD drive into the drive bay until the rails click into place.



12. Connect power and signal cables to the drive and the connectors on the system board (see “Internal cable routing and connectors” on page 40 for more information).

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 109.

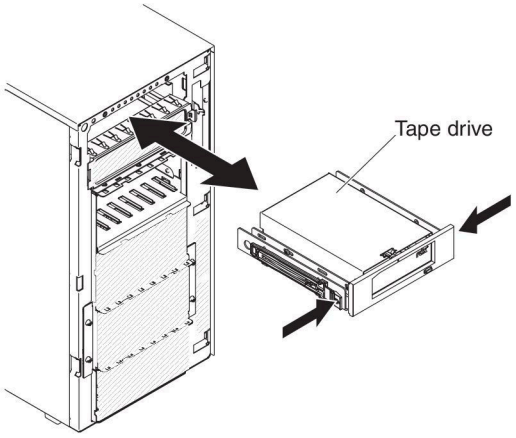
Installing an optional tape drive

To install an optional full-height tape drive, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Turn off the server and peripheral devices, and disconnect the power cords and all external cables.
3. Turn off the server and peripheral devices, and disconnect the power cords and all external cables.
4. Unlock and remove the left-side cover (see “Removing the left-side cover” on page 60).
5. Open the bezel (see “Opening the bezel media door” on page 58).
6. Remove the air baffle if installed (see “Removing the air baffle” on page 60).
7. Remove the fan cage assembly (see “Removing the fan cage assembly” on page 61).
8. Remove the EMC shields from the drive bay, if installed.
9. Touch the static-protective package that contains the tape drive to any unpainted metal surface on the server; then, remove the tape drive from the package.
10. Install the blue rails on the tape drive.
11. Follow the instructions that come with the drive to set jumpers or switches, if there is any.

    Note: You might find it easier to install the new drive from the front and then attach the cables.

12. Align the rails on the tape drive with the guides in the drive bay; then, slide the tape drive into the drive bay until the rails click into place.



13. Connect power and signal cables to the drive and the connectors on the system board (see “Internal cable routing and connectors” on page 40 for more information).

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 109.

Installing a memory module

The following notes describe the types of DIMMs that the server supports and other information that you must consider when you install DIMMs.

- When you install or remove DIMMs, the server configuration information changes. When you restart the server, the system displays a message that indicates that the memory configuration has changed.
- The server supports only industry-standard double-data-rate 3 (DDR3), 800, 1066, 1333, or 1600 MHz, PC3-6400, PC3-8500, PC3-10600, or PC3-12800 registered or unbuffered, synchronous dynamic random-access memory (SDRAM) dual inline memory modules (DIMMs) with error correcting code (ECC). See http://www.ibm.com/servers/eserver/serverproven/compat/us/ for a list of supported memory modules for the server.
  - The specifications of a DDR3 DIMM are on a label on the DIMM, in the following format.

    ggggg eRxff PC3*v-wwwwwm-aa-bb-ccd*

    where:

    ggggg is the total capacity of the DIMM (for example, 1GB, 2GB, or 4GB)

    eR is the number of ranks

    1R = single-rank

    2R = dual-rank

    4R = quad-rank

    xff is the device organization (bit width)

    x4 = x4 organization (4 DQ lines per SDRAM)

    x8 = x8 organization

    x16 = x16 organization

    v is the SDRAM and support component supply voltage (VDD)

    Blank = 1.5 V specified

L = 1.35 V specified, 1.5 V operable

Note: Values for these voltages are 'specified' which means the device characteristics such as timing are supported at this voltage. Values are 'operable' which means that the devices can be operated safely at this voltage. However, device characteristics such as timing may not be guaranteed. All devices must be 'tolerant' of the highest DDR3 nominal voltage of 1.5 V, meaning that they may not operate at 1.5 V but may be powered at that voltage without damage to the devices.

wwwww is the DIMM bandwidth, in MBps

6400 = 6.40 GBps (DDR3-800 SDRAMs, 8-byte primary data bus)

8500 = 8.53 GBps (DDR3-1066 SDRAMs, 8-byte primary data bus)

10600 = 10.66 GBps (DDR3-1333 SDRAMs, 8-byte primary data bus)

12800 = 12.80 GBps (DDR3-1600 SDRAMs, 8-byte primary data bus)

m is the DIMM type

E = Unbuffered DIMM (UDIMM) with ECC (x72-bit module data bus)

L = Load Reduction DIMM (LRDIMM)

R = Registered DIMM (RDIMM)

U = Unbuffered DIMM with no ECC (x64-bit primary data bus)

aa is the CAS latency, in clocks at maximum operating frequency

bb is the JEDEC SPD Revision Encoding and Additions level

cc is the reference design file for the design of the DIMM

d is the revision number of the reference design of the DIMM

Note: To determine the type of a DIMM, see the label on the DIMM. The information on the label is in the format xxxxx nRxxx PC3v-xxxxxx-xx-xx-xxx. The numeral in the sixth numerical position indicates whether the DIMM is single-rank (n=1), dual-rank (n=2), or quad-rank (n=4).

- The following rules apply to DDR3 RDIMM speed as it relates to the number of RDIMMs in a channel:
  - When you install 1 RDIMM per channel, the memory runs at 1600 MHz
  - When you install 2 RDIMMs per channel, the memory runs at 1600 MHz
  - When you install 3 RDIMMs per channel, the memory runs at 1066 MHz
  - All channels in a server run at the fastest common frequency
  - Do not install registered, unbuffered, and load reduction DIMMs in the same server
- The maximum memory speed is determined by the combination of the microprocessor, DIMM speed, DIMM type, Operating Modes in UEFI settings, and the number of DIMMs installed in each channel.
- In two-DIMM-per-channel configuration, a server with an Intel Xeon™ E5-2600 series microprocessor automatically operates with a maximum memory speed of up to 1600 MHz when the following condition is met:
  - Two 1.35 V single-rank, dual-ranl, or quad-rank UDIMMs, RDIMMs or LRDIMMs are installed in the same channel. In the Setup utility, **Memory speed** is set to **Max performance** and **LV-DIMM power** is set to **Enhance performance** mode. The 1.35 V UDIMMs, RDIMMs or LRDIMMs will function at 1.5 V.
- The server supports a maximum of 16 dual-rank UDIMMs. The server supports up to two UDIMMs per channel.

- The server supports a maximum of 24 single-rank, dual-rank, or 16 quad-rank RDIMMs. The server does not support three quad-rank RDIMMs in the same channel.
- The following table shows an example of the maximum amount of memory that you can install using ranked DIMMs:

Table 5. Maximum memory installation using ranked DIMMs

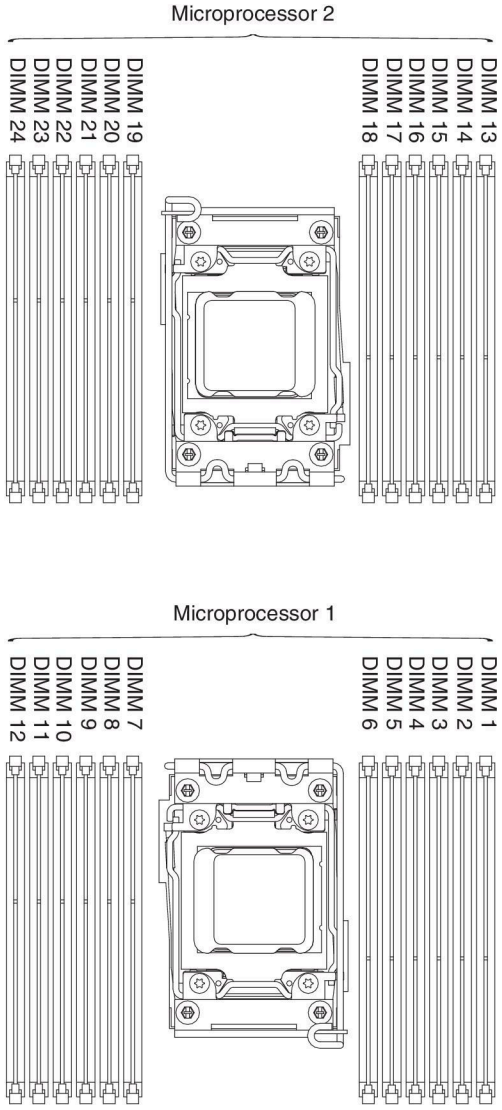
Number of DIMMs	DIMM type	DIMM size	Total memory
16	Single-rank UDIMMs	2 GB	32 GB
24	Single-rank RDIMMs	2 GB	48 GB
24	Single-rank RDIMMs	4 GB	96 GB
24	Dual-rank RDIMMs	8 GB	192 GB
24	Dual-rank RDIMMs	16 GB	384 GB
16	Quad-rank RDIMMs	16 GB	256 GB
24	Quad-rank LRDIMMs	32 GB	768 GB

- The UDIMM option that is available for the server is 2 GB. The server supports a minimum of 2GB and a maximum of 32 GB of system memory using UDIMMs.
- The RDIMM options that are available for the server are 2 GB, 4 GB, 8 GB, and 16 GB. The server supports a minimum of 2 GB and a maximum of 384 GB of system memory using RDIMMs.
- The LRDIMM option that is available for the server is 32 GB. The server supports a minimum of 32 GB and a maximum of 768 GB of system memory using LRDIMMs.

  Note: The amount of usable memory is reduced depending on the system configuration. A certain amount of memory must be reserved for system resources. To view the total amount of installed memory and the amount of configured memory, run the Setup utility. For additional information, see Chapter 3, “Configuring the server,” on page 117.
- A minimum of one DIMM must be installed for each microprocessor. For example, you must install a minimum of two DIMMs if the server has two microprocessors installed. However, to improve system performance, install a minimum of four DIMMs for each microprocessor.
- DIMMs in the server must be the same type (RDIMM, UDIMM, or LRDIMM) to ensure that the server will operate correctly.
- When you install one quad-rank DIMM in a channel, install it in the DIMM connector furthest away from the microprocessor.
- For UDIMMs, DIMM connectors 3, 6, 7, and 10 for microprocessor 1 and DIMM connectors 15, 18, 19, and 22 for microprocessor 2 are not used.

Note: You can install DIMMs for microprocessor 2 as soon as you install microprocessor 2; you do not have to wait until all of the DIMM slots for microprocessor 1 are filled.

The following illustration shows the location of the DIMM connectors on the system board.



DIMM installation sequence

Depending on the server model, the server may come with a minimum of one 2 GB or 4 GB DIMM installed in slot 1. When you install additional DIMMs, install them in the order shown in the following table to optimize system performance. In general, all three channels on the memory interface for each microprocessor can be populated in any order and have no matching requirements.

Table 6. Independent mode DIMM installation sequence

Number of installed microprocessor	**DIMM connector population sequence**
One microprocessor installed	1, 4, 9, 12, 2, 5, 8, 11, 10, 7, 6, 3
Two microprocessors installed	1, 13, 4, 16, 9, 21, 12, 24, 2, 14, 5, 17, 8, 20, 11, 23, 22, 10, 19, 7, 18, 6, 15, 3

Memory mirrored channel

Memory mirrored channel mode replicates and stores data on two pairs of DIMMs within two channels simultaneously. If a failure occurs, the memory controller switches from the primary pair of memory DIMMs to the backup pair of DIMMs. You can enable memory mirrored in the Setup utility (see “Starting the Setup utility” on page 121). When you use the memory mirrored channel feature, consider the following information:

- When you use memory mirrored channel, you must install a pair of DIMMs at a time. The two DIMMs in each pair must be identical in size, type, and rank (single, dual, or quad), and organization, but not in speed. The channels run at the speed of the slowest DIMM in any of the channels.
- The maximum available memory is reduced to half of the installed memory when memory mirrored is enabled. For example, if you install 64 GB of memory using RDIMMs, only 32 GB of addressable memory is available when you use memory mirrored channel.

The following diagram lists the DIMM connectors on each memory channel.

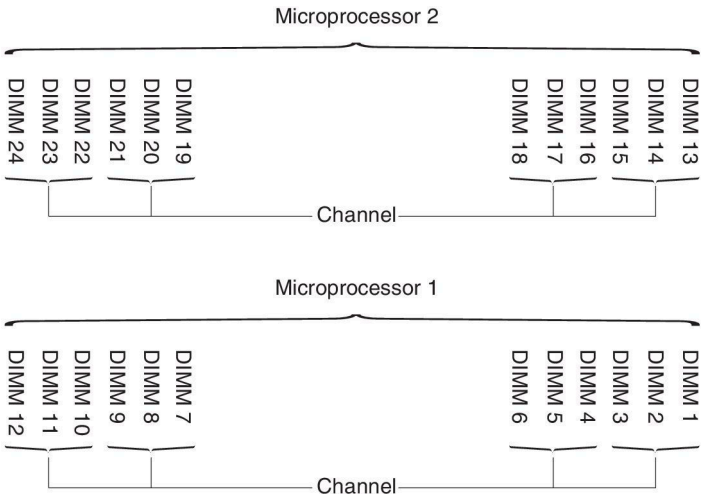


Figure 13. Connectors on each memory channel

Note: You can install DIMMs for microprocessor 2 as soon as you install microprocessor 2; you do not have to wait until all of the DIMM connectors for microprocessor 1 are filled.

The following table shows the installation sequence for memory mirrored mode:

Table 7. Memory mirrored channel mode DIMM population sequence

Number of DIMMs	Number of installed microprocessor	DIMM connector
First pair of DIMMs	1	1, 4
Second pair of DIMMs	1	9, 12
Third pair of DIMMs	1	2, 5
Fourth pair of DIMMs	1	8, 11
Fifth pair of DIMMs	1	7, 10
Sixth pair of DIMMs	1	3, 6

Table 7. Memory mirrored channel mode DIMM population sequence (continued)

Number of DIMMs	Number of installed microprocessor	DIMM connector
Seventh pair of DIMMs	2	13, 16
Eighth pair of DIMMs	2	21, 24
Ninth pair of DIMMs	2	14, 17
Tenth pair of DIMMs	2	20, 23
Eleventh pair of DIMMs	2	19, 22
Twelfth pair of DIMMs	2	15, 18
Note: DIMM connectors 3, 6, 7, 10, 15, 18, 19, and 22 are not used in memory mirrored mode when UDIMMs are installed in the server.		

When you install or remove DIMMs, the server configuration information changes. When you restart the server, the system displays a message that indicates that the memory configuration has changed.

Memory rank sparing

Sparing enables a failing rank to be replaced by ranks installed in an unoccupied space. An unused spare rank on the channel can be used to copy the contents of a failing rank on that channel. You can enable rank sparing memory in the Setup utility, select **System Settings → Memory**. For more information, see “Using the Setup utility” on page 120.

The following diagram lists the DIMM connectors on each memory channel.

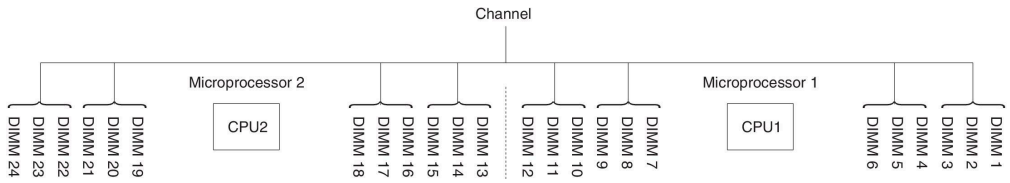


Figure 14. Connectors on each memory channel

You can install DIMMs for the microprocessor 2 once the microprocessor 2 is installed. You do not need to wait until all of the DIMM connectors for microprocessor 1 are filled. The following table shows the installation sequence for memory rank sparing mode:

Table 8. Memory rank sparing mode DIMM population sequence

Number of DIMMs	Number of installed microprocessor	DIMM connector
First pair of DIMMs	1	1, 2
Second pair of DIMMs	1	4, 5
Third pair of DIMMs	1	8, 9
Fourth pair of DIMMs	1	11, 12
Fifth pair of DIMMs	1	7, 10
Sixth pair of DIMMs	1	3, 6
Seventh pair of DIMMs	2	13, 14

Table 8. Memory rank sparing mode DIMM population sequence (continued)

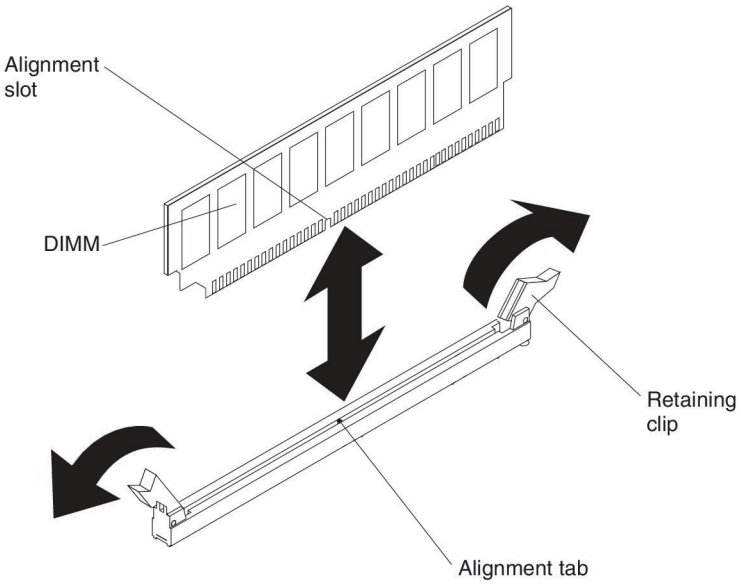
Number of DIMMs	Number of installed microprocessor	DIMM connector
Eighth pair of DIMMs	2	16, 17
Ninth pair of DIMMs	2	20, 21
Tenth pair of DIMMs	2	23, 24
Eleventh pair of DIMMs	2	19, 22
Twelfth pair of DIMMs	2	15, 18
Note: DIMM connectors 3, 6, 7, 10, 15, 18, 19, and 22 are not used in memory rank sparing mode when UDIMMs are installed in the server.		

Installing a DIMM

To install a DIMM, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Turn off the server and peripheral devices and disconnect the power cords and all external cables, if necessary.
3. Unlock and remove the left-side cover (see “Removing the left-side cover” on page 60).
4. Remove the air baffle if installed (see “Removing the air baffle” on page 60).
5. Open the retaining clip on each end of the DIMM connector.

   Attention: To avoid breaking the retaining clips or damaging the DIMM connectors, open and close the clips gently.



6. Touch the static-protective package that contains the DIMM to any unpainted metal surface on the outside of the server. Then, remove the DIMM from the package.
7. Turn the DIMM so that the alignment slot align correctly with the alignment tab.
8. Insert the DIMM into the connector by aligning the edges of the DIMM with the slots at the ends of the DIMM connector (see “System-board internal connectors” on page 31for the locations of the DIMM connectors).

9. Firmly press the DIMM straight down into the connector by applying pressure on both ends of the DIMM simultaneously. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector.

   Note: If there is a gap between the DIMM and the retaining clips, the DIMM has not been correctly inserted; open the retaining clips, remove the DIMM, and then reinsert it.

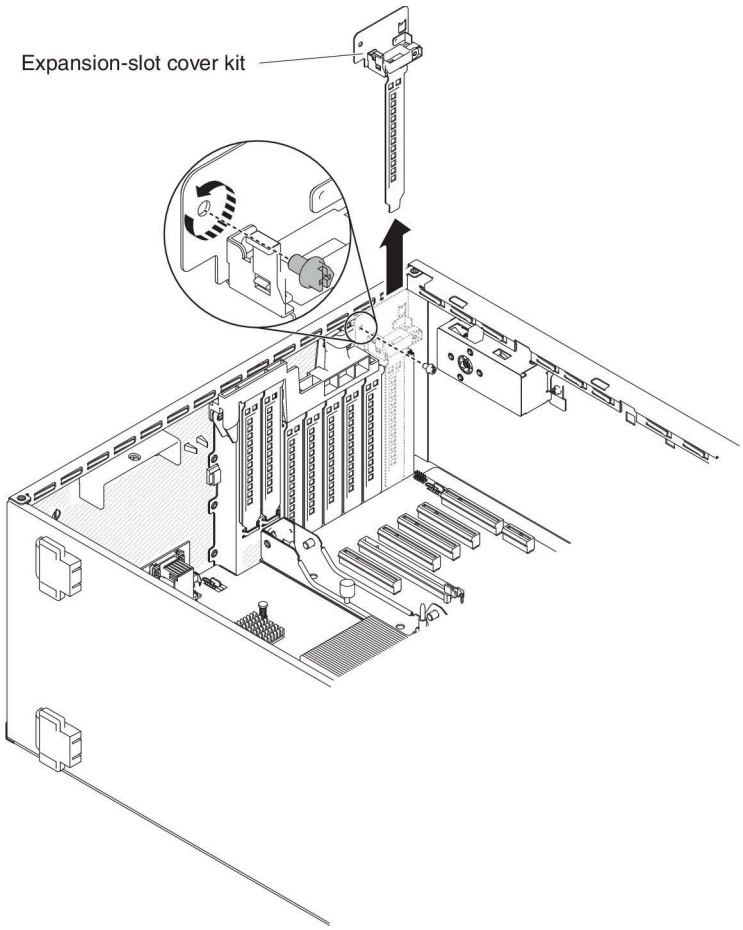
   If you have other devices to install or remove, do so now. Otherwise, go to "Completing the installation" on page 109.

Installing a PCI-X bracket

To replace a PCI-X bracket, complete the following steps:

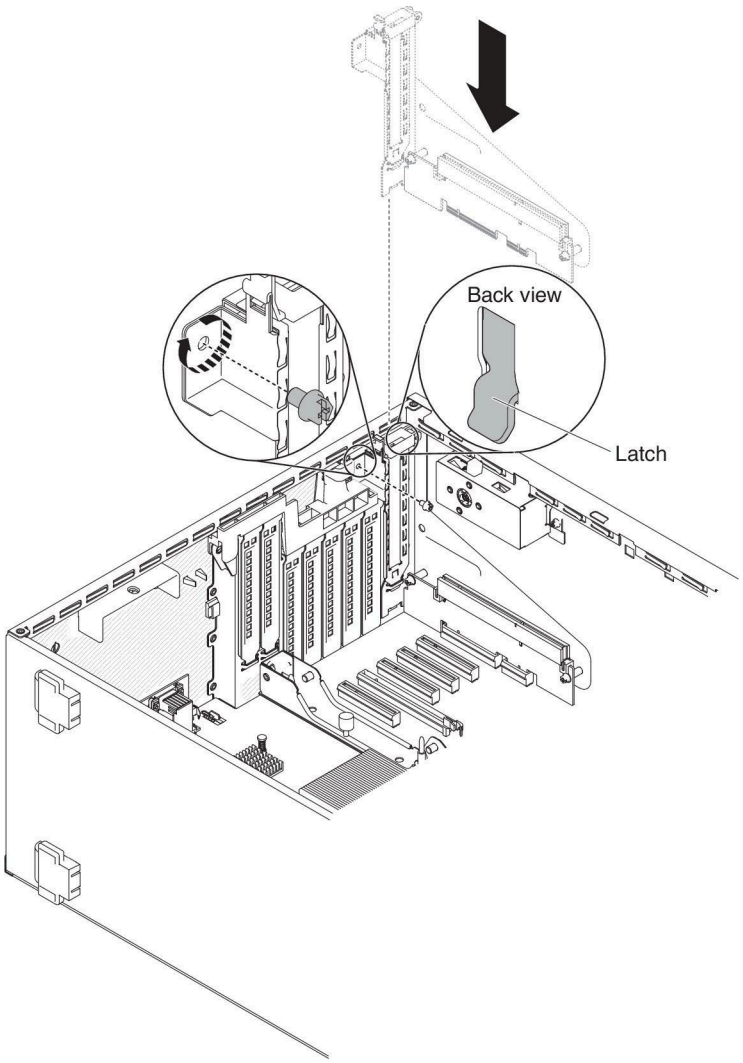
1. Read the safety information that begins on page vii and the "Installation guidelines" on page 37.
2. Turn off the server and peripheral devices and disconnect the power cords and all external cables.
3. Carefully turn the server on its side so that it is lying flat, with the cover facing up.

   Attention: Do not allow the server to fall over.
4. Unlock and remove the left-side cover (see "Removing the left-side cover" on page 60).
5. Touch the static-protective package that contains the adapter to any unpainted metal surface on the server; then, remove the adapter from the package.
6. Locate PCI slot 1 which you will install the PCI-X bracket.
7. Remove the screw that secures the expansion-slot cover.



8. Remove the expansion-slot cover kit in PCI slot 1 and save it for future use.
9. Press the PCI-X bracket *firmly* into PCI slot 1.

   Attention: Incomplete insertion might cause damage to the system board or the adapter.
10. Make sure the latch on the side of the PCI-X bracket is secured to the rear of the server chassis.



11. Install the screw that secures the PCI-X bracket to the server.

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 109.

Installing an adapter

The following notes describe the types of adapters that the server supports and other information that you must consider when you install an adapter:

- To confirm that the server supports the adapter that you are installing, see http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/.
- Locate the documentation that comes with the adapter and follow those instructions in addition to the instructions in this section.
- Do not set the maximum digital video adapter resolution above 1600 x 1200 at 75 Hz for an LCD monitor. This is the highest resolution that is supported for any add-on video adapter that you install in the server.
- Avoid touching the components and gold-edge connectors on the adapter.
- The server uses a rotational interrupt technique to configure PCI adapters so that you can install PCI adapters that do not support sharing of PCI interrupts.

- The following table lists the option part numbers and CRU part numbers for the network adapters.

Table 9. Network adapters

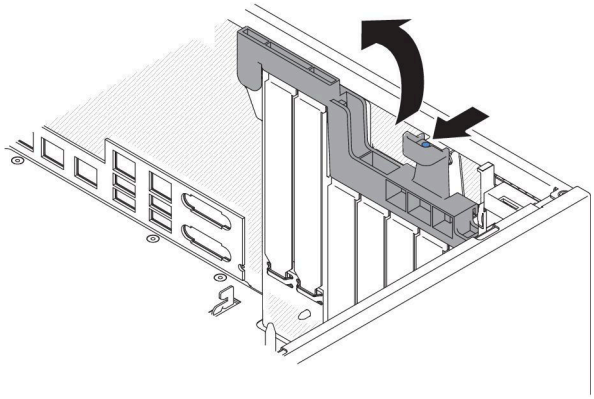
Network Adapters		
Description	**Option part number**	**CRU part number**
NetXtreme II 1000 express Ethernet adapter	39Y6066	39Y6070
NetXtreme II 1000 express dual-port Ethernet adapter	42C1780	49Y7947
QLogic 10Gb CNA	42C1800	42C1802
QLogic 8Gb FC dual-port HBA	42D0510	42D0516
NetXtreme II 1000 express quad-port Ethernet adapter	49Y4220	49Y7949
Intel Ethernet dual-port server adapter I340-T2	49Y4230	49Y4232
Intel Ethernet quad-port server adapter I340-T4	49Y4240	49Y4242
Broadcom NetXtreme II dual-port 10GBaseT adapter	49Y7910	49Y7912
Intel X520-DA2 dual-port 10GbE SFP adapter	49Y7960	49Y7962
Intel X540-T2 dual-port 10GBaseT adapter	49Y7970	49Y7972
Broadcom NetXtreme I quad-port GbE adapter	90Y9352	90Y9355
Broadcom NetXtreme I dual-port GbE adapter	90Y9370	90Y9373
Emulex 10 GbE virtual fabric adapter III	95Y3762	9573766
Emulex 10 GbE virtual fabric adapter III lite	95Y3768	95Y3766

Attention: Static electricity that is released to internal server components when the server is powered-on might cause the server to stop, which might result in the loss of data. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding system when working inside the server with the power on.

To install an adapter, complete the following steps:

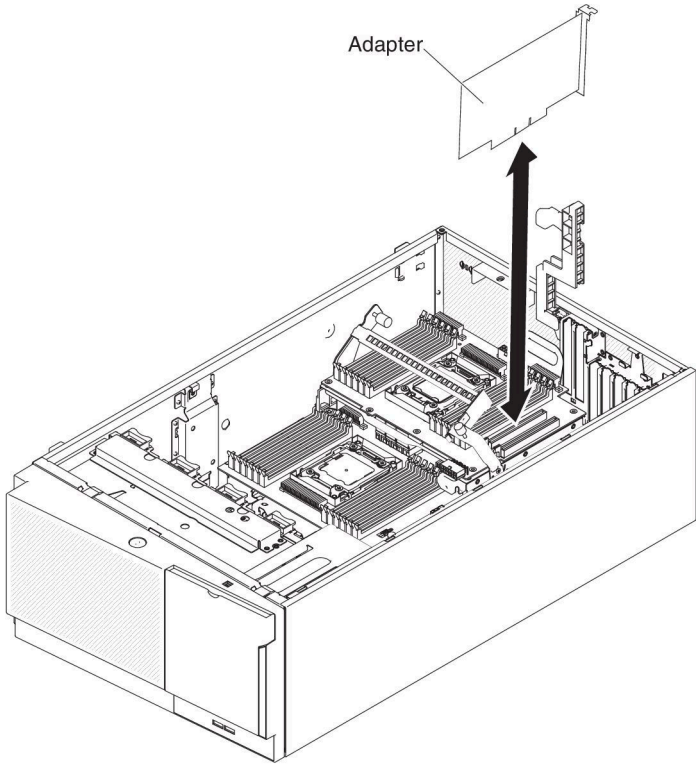
1. Read the safety information that begins on page vii and the “Installation guidelines” on page 37.
2. Turn off the server and peripheral devices and disconnect the power cords and all external cables.
3. Carefully turn the server on its side so that it is lying flat, with the cover facing up.

   Attention: Do not allow the server to fall over.
4. Unlock and remove the server cover (see “Removing the left-side cover” on page 60).
5. See the documentation that comes with the adapter for any cabling instructions and information about jumper or switch settings. (It might be easier for you to route cables before you install the adapter.)
6. Touch the static-protective package that contains the adapter to any unpainted metal surface on the server; then, remove the adapter from the package.
7. Determine the PCI slot into which you will install the adapter.
8. Rotate the adapter-retention brackets to the open position.



9. Remove the PCI slot filler, if installed. Keep the filler in a safe place for potential future use.

10. Press the adapter *firmly* into the expansion slot.



Attention: Incomplete insertion might cause damage to the system board or the adapter.

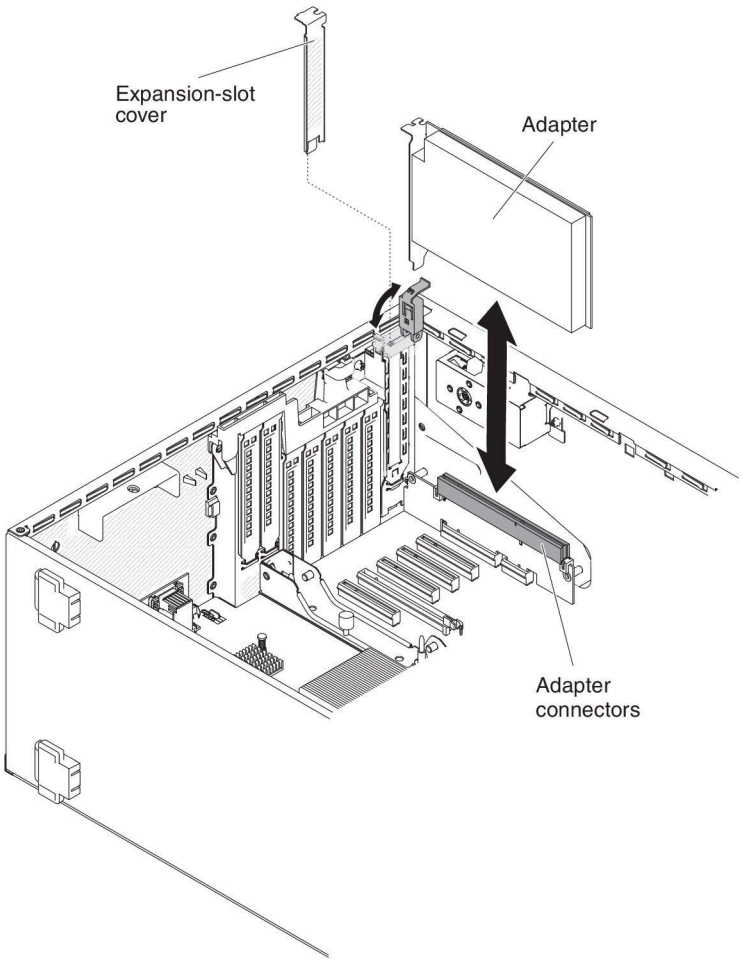
11. Close the adapter-retention bracket.
12. Perform any configuration tasks that are required for the adapter.

To install an adapter on the PCI-X bracket, complete the following steps:

1. Read the safety information that begins on page vii and the “Installation guidelines” on page 37.
2. Turn off the server and peripheral devices and disconnect the power cords and all external cables.
3. Carefully turn the server on its side so that it is lying flat, with the cover facing up.

   Attention: Do not allow the server to fall over.
4. Unlock and remove the server cover (see “Removing the left-side cover” on page 60).
5. See the documentation that comes with the adapter for any cabling instructions and information about jumper or switch settings. (It might be easier for you to route cables before you install the adapter.)
6. Touch the static-protective package that contains the adapter to any unpainted metal surface on the server; then, remove the adapter from the package.
7. Locate PCI slot 1 which you will install the adapter into.
8. Rotate the adapter-retention brackets on the PCI-X bracket to the open position.

   Note: Remove the expansion-slot cover if it is installed on the PCI-X bracket and save it for future use.



9. Remove the PCI slot filler, if installed. Keep the filler in a safe place for potential future use.
10. Press the adapter *firmly* into the expansion slot.

    Attention: Incomplete insertion might cause damage to the system board or the adapter.
11. Perform any configuration tasks that are required for the adapter.

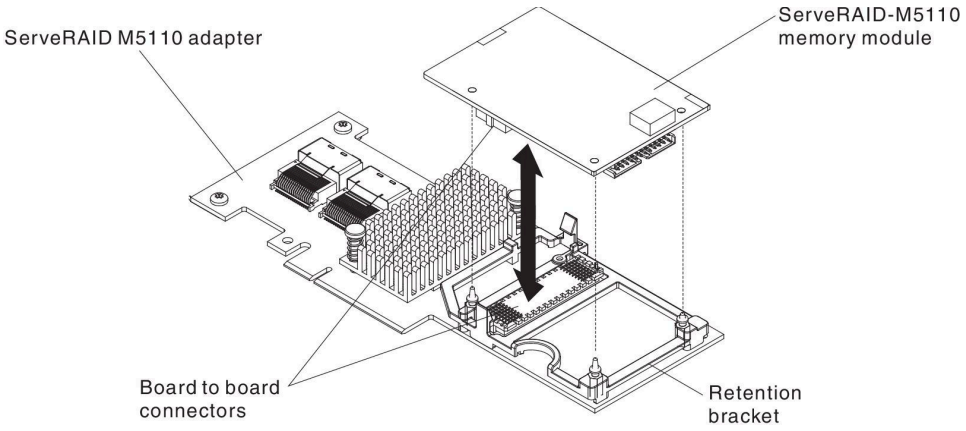
If you have other devices to install or remove, do so now. Otherwise, go to "Completing the installation" on page 109.

Installing an optional ServeRAID adapter memory module

To install an optional ServeRAID adapter memory module, complete the following steps:

1. Read the safety information that begins on page vii and "Installation guidelines" on page 37.
2. Turn off the server and peripheral devices and disconnect the power cords.
3. Remove the cover (see "Removing the left-side cover" on page 60).
4. Locate the ServeRAID adapter which you will install the memory module. Remove the ServeRAID adapter if necessary.
5. Touch the static-protective package that contains the memory card to any unpainted metal surface on the server; then, remove the memory card from the package.

6. Align the memory module with the connector on the ServeRAID adapter and push it into the connector until it is firmly seated.



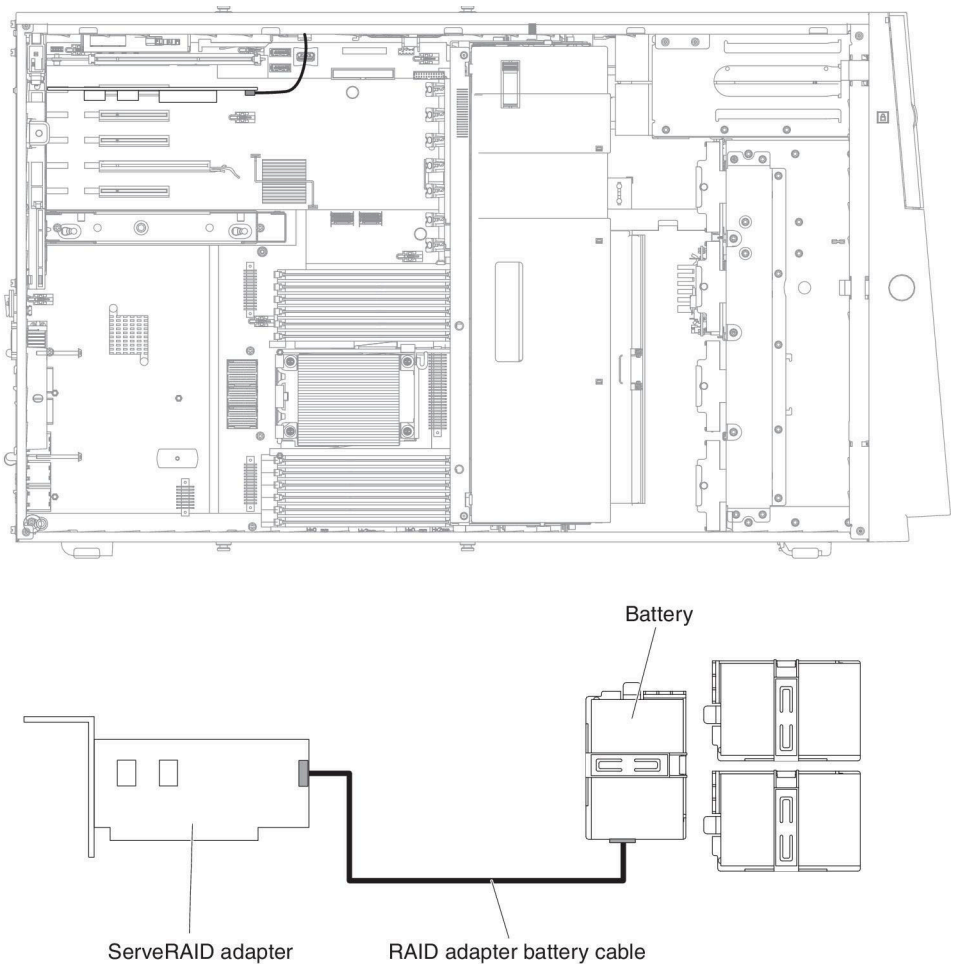
If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 109.

Installing a RAID adapter battery remotely in the server

When you install any RAID adapter that comes with batteries, it is sometimes necessary to install the batteries in another location in the server to prevent the batteries from overheating.

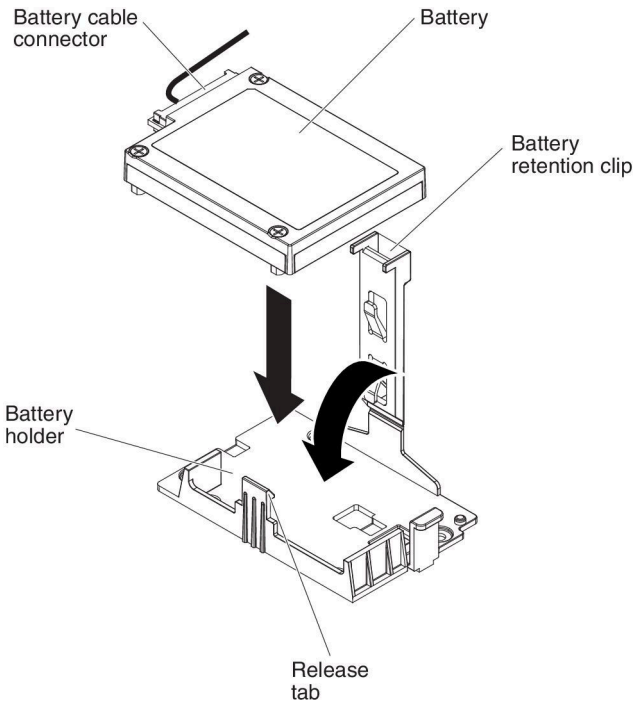
To install a RAID adapter battery in the server, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Turn off the server and peripheral devices and disconnect all power cords and external devices.
3. Remove the cover (see “Removing the left-side cover” on page 60).
4. Install the ServeRAID adapter on the system board (see “Installing an adapter” on page 86) .
5. Connect one end of the battery cable to the RAID adapter battery connector.
6. Route the remote battery cable as shown in the following illustration.



Attention: Make sure that the cable is not pinched and does not cover any connectors or obstruct any components on the system board.

7. Install the battery:
   a. Align the battery cable connector with the slot on the battery holder. Place the battery into the battery holder and make sure that the battery holder engages the battery securely.



Note: The positioning of the remote battery depends on the type of the remote batteries that you install.

b. Connect the other end of the battery cable to the battery cable connector on the battery.

c. Lower and press down on the retention clip until it snaps in place to hold the battery firmly in place.

If you have other devices to install or remove, do so now. Otherwise, go to "Completing the installation" on page 109.

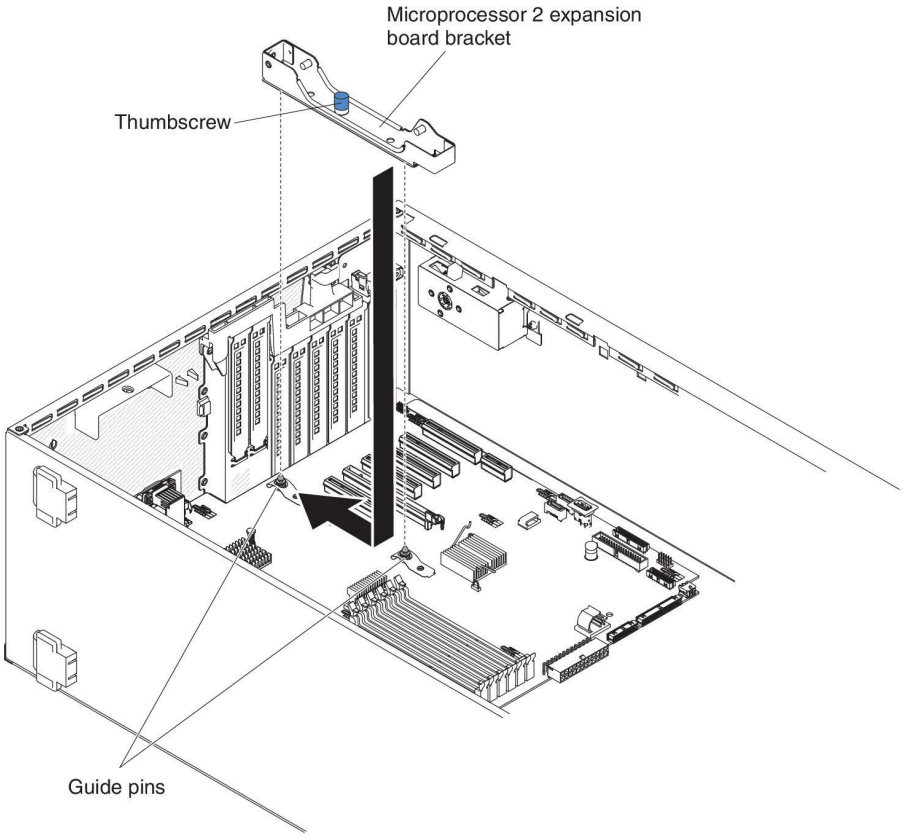
Installing the microprocessor 2 expansion board

To install the microprocessor 2 expansion board, complete the following steps:

1. Read the safety information that begins on page vii and "Installation guidelines" on page 37.
2. Turn off the server and all attached devices; then, disconnect all power cords and external cables.
3. Carefully turn the server on its side so that it is lying flat, with the cover facing up.

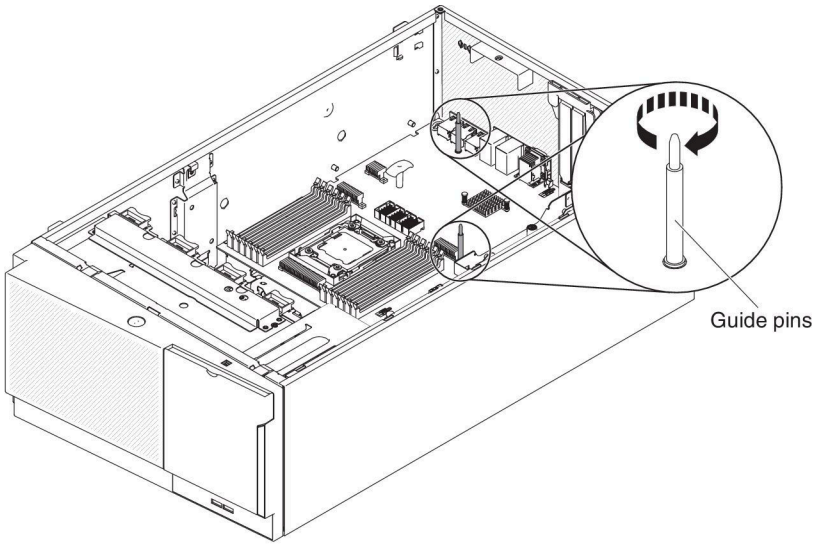
   Attention: Do not allow the server to fall over.
4. Unlock and remove the left-side cover (see "Removing the left-side cover" on page 60).
5. Remove the fan cage assembly (see "Removing the fan cage assembly" on page 61).
6. Touch the static-protective package that contains the microprocessor 2 expansion board to any unpainted metal surface on the server; then, remove the microprocessor 2 expansion board from the package.
7. Install the microprocessor 2 expansion board side bracket.

a. Align the side bracket with the holes on the chassis and install the side bracket on the system board.

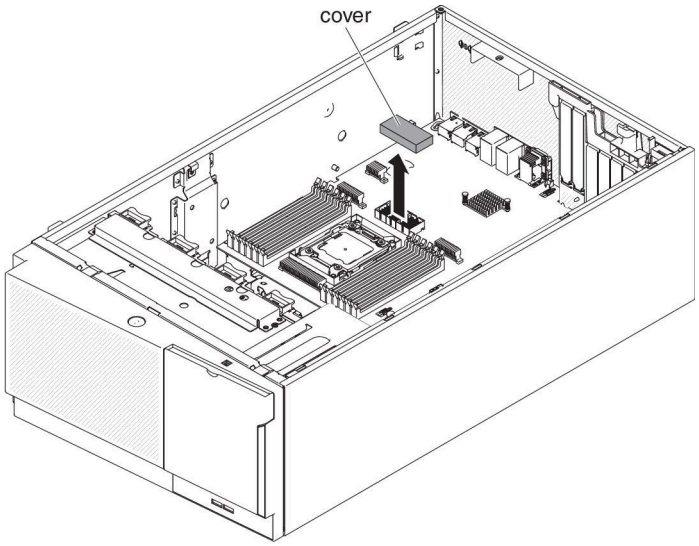


b. Slide the side bracket toward the rear of the server.
c. Fasten the thumbscrew on the side bracket.

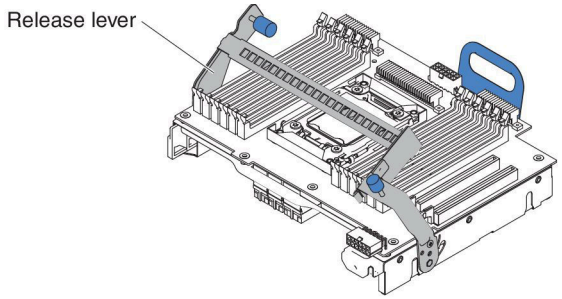
8. Install the two guide pins on the system board.



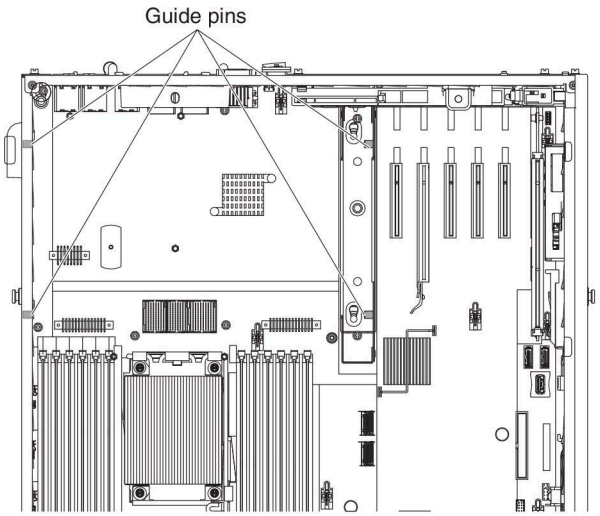
9. Remove the cover on the microprocessor 2 expansion board connector from the system board.



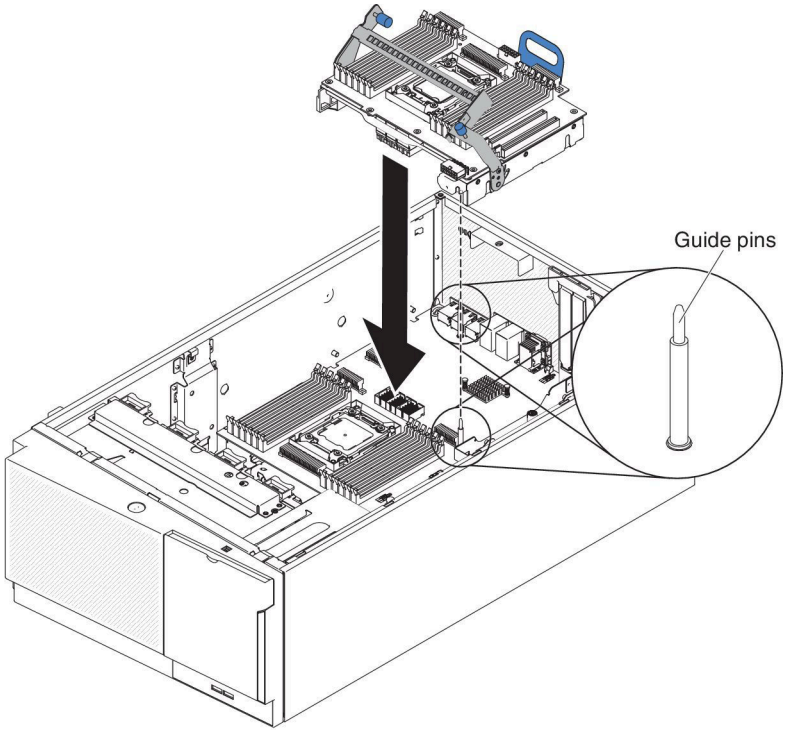
10. Make sure the microprocessor 2 expansion board release lever is in the open position.



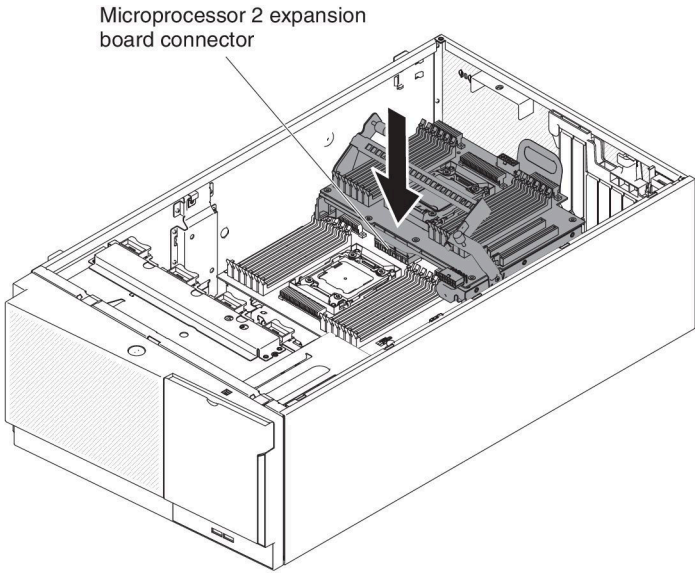
11. Align the microprocessor 2 expansion board to the guide pins on the bottom of the chassis and the side bracket.



12. Align the holes on the microprocessor 2 expansion board to the guide pins on the system board. Install the microprocessor 2 expansion board on the system board.



13. Press the microprocessor 2 expansion board firmly and horizontally to the system board.

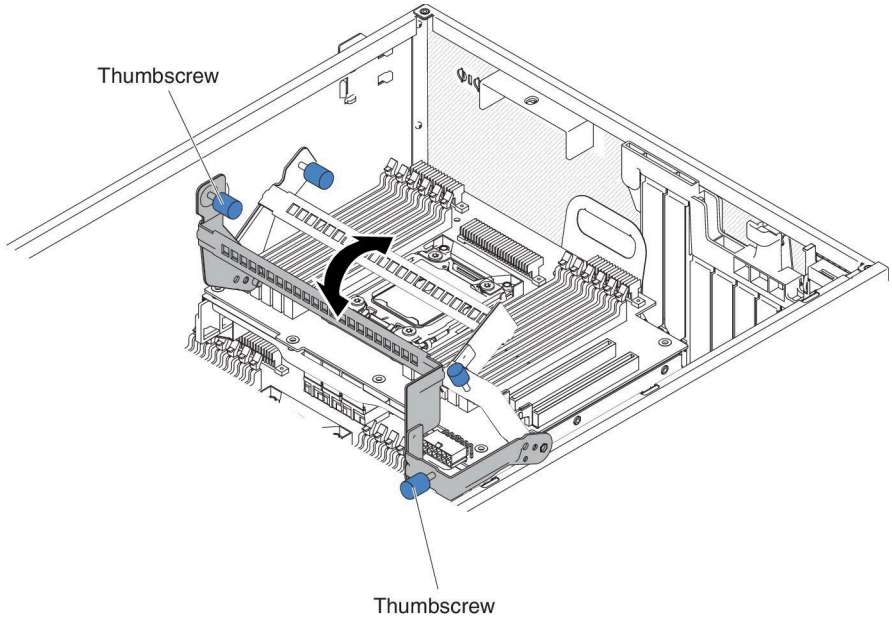


Notes:

a. Static electricity that is released to internal server components when the server is powered-on might cause the server to halt, which might result in the loss of data. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding system when you work inside the server with the power on.

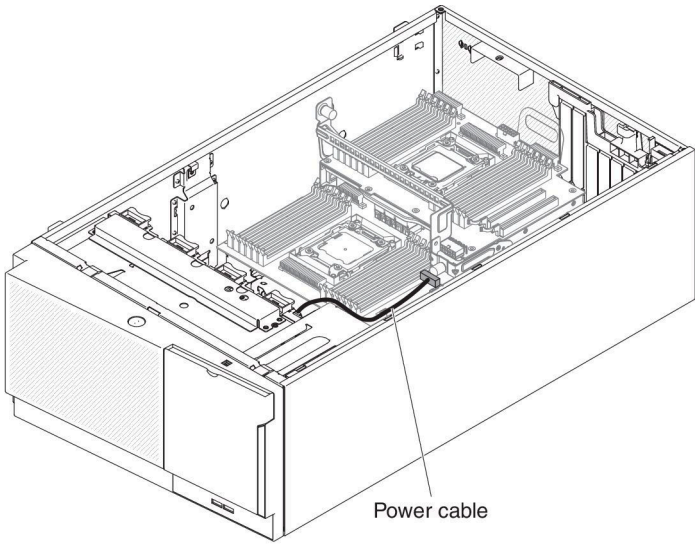
b. Make sure that none of the server cables are caught under the microprocessor 2 expansion board.

14. Rotate the release lever toward the front of the server to secure the microprocessor 2 expansion board in place.

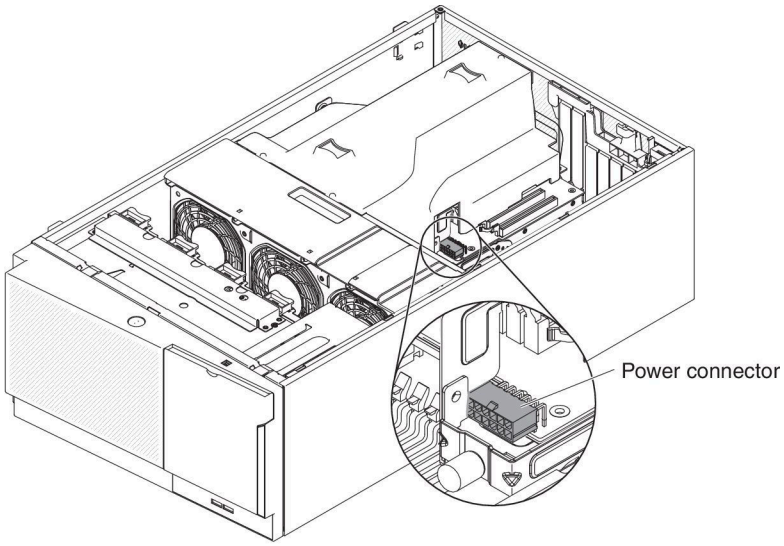


Note: Press the microprocessor 2 expansion board connector to make sure the connector is seated securely on the system board.

15. Fasten the two thumbscrews on the release lever.
16. Route the power cable to the microprocessor 2 expansion board power connector from the power paddle card.



17. Connect the power cable to the microprocessor 2 expansion board power connector from the power paddle card.



Note: You might need to install the air baffle before connecting the power cable.

If you have other devices to install or remove, do so now. Otherwise, go to "Completing the installation" on page 109.

Installing a second microprocessor and heat sink

The following notes describe the type of microprocessor that the server supports and other information that you must consider when you install a microprocessor and heat sink:

- Microprocessors are to be installed only by trained technicians.

Important: Always use the microprocessor installation tool to install a microprocessor. Failing to use the microprocessor installation tool may damage the microprocessor sockets on the system board. Any damage to the microprocessor sockets may require replacing the system board.

- The server supports certain Intel Xeon scalable multi-core microprocessors, which are designed for the LGA 2011 socket. These microprocessors are 64-bit dual-core or quad-core microprocessors with an integrated memory controller, quick-path interconnect, and shared last cache. See http://www.ibm.com/servers/eserver/serverproven/compat/us/ for a list of supported microprocessors.
- Do not mix microprocessors with different cores in the same server.
- The server supports up to two microprocessors when the microprocessor 2 expansion board is installed.

  Note: Microprocessor 2 expansion board is supported when the second microprocessor is installed.
- When two microprocessors are installed, the air baffle and fan 2 must be installed to provide proper system cooling.
- When you install the second microprocessor, you must also install additional memory, the air baffle, and fan 2. See “Installing a memory module” on page 77 for details about the installation sequence.
- To ensure proper server operation when you install an additional microprocessor, use microprocessors that have the same QuickPath Interconnect (QPI) link speed, integrated memory controller frequency, core frequency, power segment, internal cache size, and type.
- Mixing microprocessors of different stepping levels within the same server model is supported.
- When mixing microprocessors with different stepping levels within the same server model, you do not have to install the microprocessor with lowest stepping level and features in microprocessor socket 1.
- Read the documentation that comes with the microprocessor to determine whether you have to update the server firmware. To download the latest level of server firmware and other code updates for the server, go to http://www.ibm.com/support/fixcentral/.
- The microprocessor speeds are automatically set for this server; therefore, you do not have to set any microprocessor frequency-selection jumpers or switches.
- If the thermal-grease protective cover (for example, a plastic cap or tape liner) is removed from the heat sink, do not touch the thermal grease on the bottom of the heat sink or set down the heat sink. For details, see the information about thermal grease in the *Problem Determination and Service Guide*.

  Note: Removing the heat sink from the microprocessor destroys the even distribution of the thermal grease and requires replacing the thermal grease.
- Do not remove the first microprocessor from the system board to install the second microprocessor.
- To order an additional optional microprocessor, contact your IBM marketing representative or authorized reseller.

To install an additional microprocessor and heat sink, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.

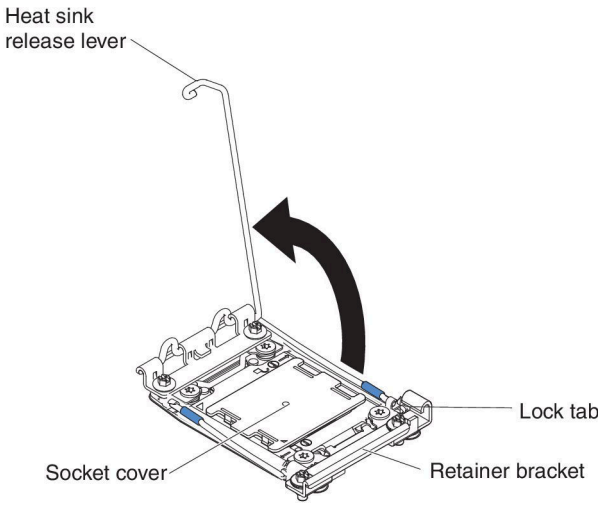
2. Turn off the server and peripheral devices and disconnect the power cords and all external cables (see “Turning off the server” on page 27).

   Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling these devices, see “Handling static-sensitive devices” on page 39.

3. Carefully turn the server on its side so that it is lying flat, with the cover facing up.

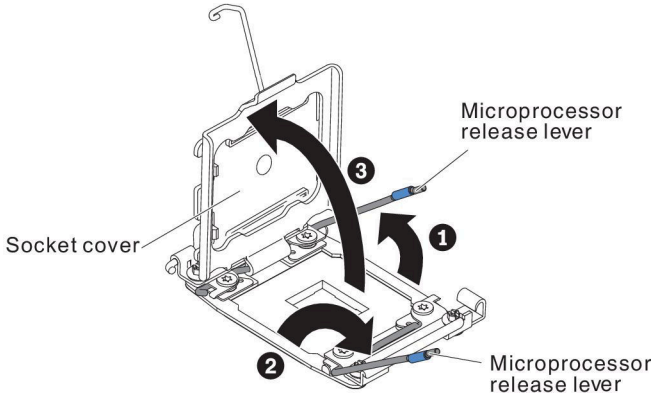
   Attention: Do not allow the server to fall over.

4. Unlock and remove the left-side cover (see “Removing the left-side cover” on page 60).
5. Locate microprocessor socket 2 on the microprocessor 2 expansion board.
6. Rotate the heat sink retention module release lever to the open position.



7. Open the microprocessor socket release levers and retainer:
   a. Identify which release lever is labeled as the first release lever to open and open it.
   b. Open the second release lever on the microprocessor socket.
   c. Open the microprocessor retainer.

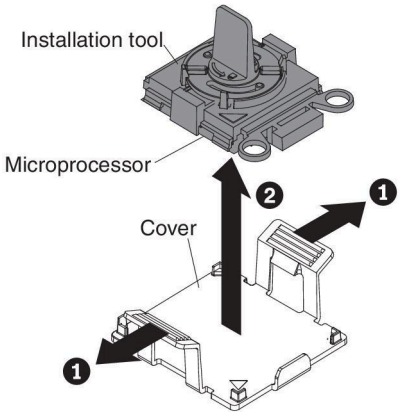
      Attention: Do not touch the connectors on the microprocessor and the microprocessor socket.



8. Install the microprocessor on the microprocessor socket:

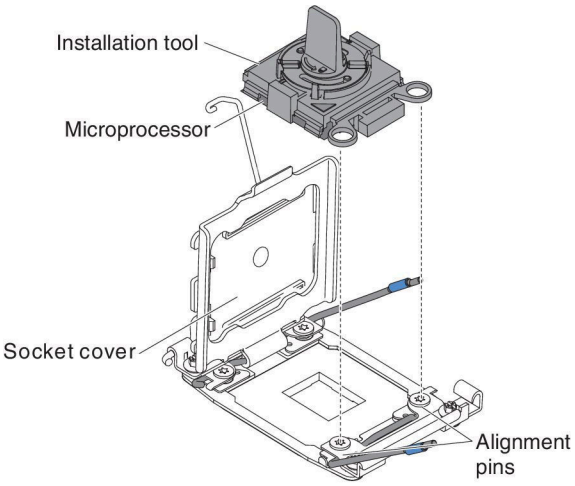
a. Touch the static-protective package that contains the new microprocessor to any *unpainted* on the chassis or any *unpainted* metal surface on any other grounded rack component; then, carefully remove the microprocessor from the package.

b. Release the sides of the cover and remove the cover from the installation tool. The microprocessor is preinstalled on the installation tool.

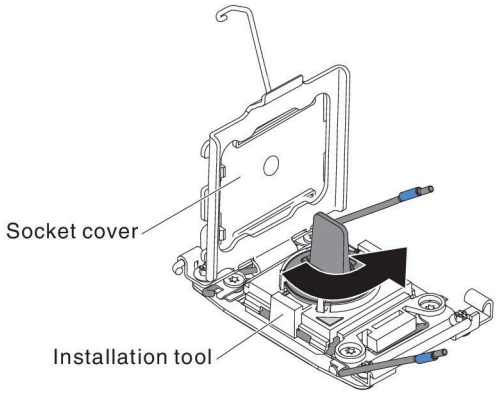


Note: Do not touch the microprocessor contacts. Contaminants on the microprocessor contacts, such as oil from your skin, can cause connection failures between the contacts and the socket.

c. Align the installation tool with the microprocessor socket. The installation tool rests flush on the socket only if properly aligned.



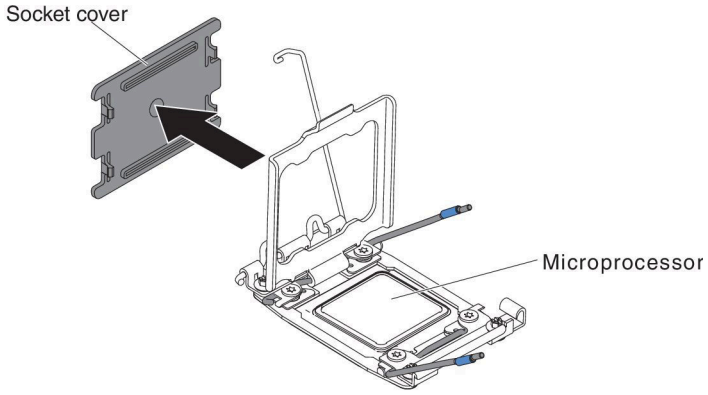
d. Twist the handle on the microprocessor tool counterclockwise to insert the microprocessor into the socket. The microprocessor is keyed to ensure that the microprocessor is installed correctly. The microprocessor rests flush on the socket only if properly installed.



Attention:

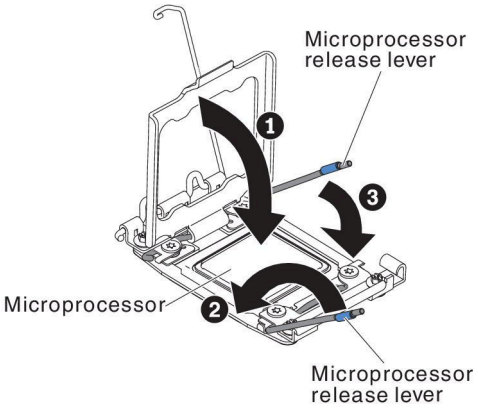
- Do not press the microprocessor into the socket.
- Make sure that the microprocessor is oriented and aligned correctly in the socket before you try to close the microprocessor retainer.
- Do not touch the thermal material on the bottom of the heat sink or on top of the microprocessor. Touching the thermal material will contaminate it.

9. Remove the microprocessor socket dust cover, tape, or label from the surface of the microprocessor socket, if one is present. Store the socket cover in a safe place.



Attention: When you handle static-sensitive devices, take precautions to avoid damage from static electricity. For details about handling these devices, see “Handling static-sensitive devices” on page 39.

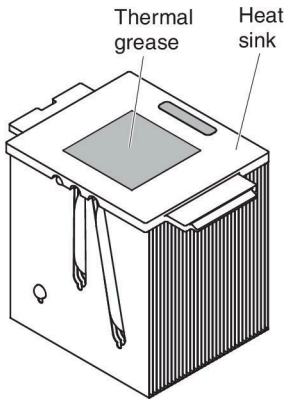
10. Close the microprocessor socket release levers and retainer:
    a. Close the microprocessor retainer on the microprocessor socket.
    b. Identify which release lever is labeled as the first release lever to close and close it.
    c. Close the second release lever on the microprocessor socket.



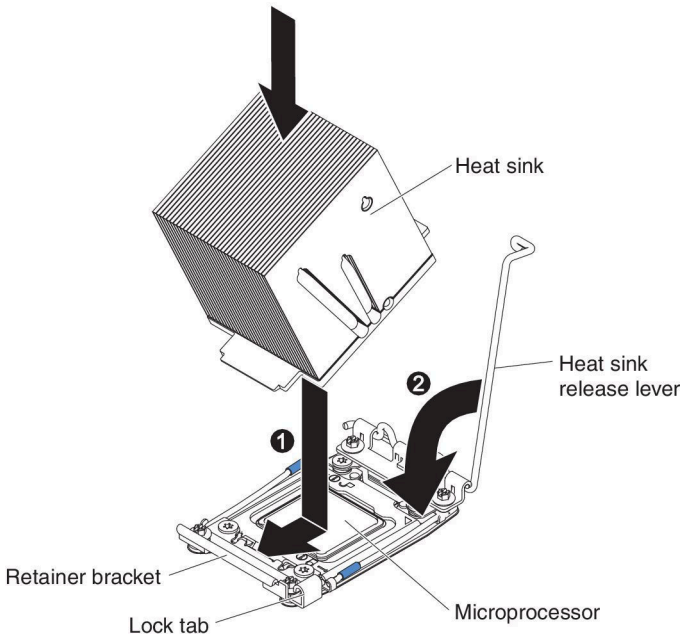
11. Install the heat sink:

    Attention:

    - Do not set down the heat sink after you remove the plastic cover.
    - Do not touch the thermal grease on the bottom of the heat sink after you remove the plastic cover. Touching the thermal grease will contaminate it. See “Thermal grease” on page 105 for more information.



    a. Remove the plastic protective cover from the bottom of the heat sink.
    b. Position the heat sink over the microprocessor. The heat sink is keyed to assist with proper alignment.
    c. Align and place the heat sink on top of the microprocessor in the retention bracket, thermal material side down.
    d. Press firmly on the heat sink.
    e. Rotate the heat sink retention module release lever to the closed position and hook it underneath the lock tab.



12. If you installed the second microprocessor, install the air baffle (see “Replacing the air baffle” on page 112) and fan 2 (see “Installing a simple-swap fan” on page 63).

If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation” on page 109.

Thermal grease

The thermal grease must be replaced whenever the heat sink has been removed from the top of the microprocessor and is going to be reused or when debris is found in the grease.

When you are installing the heat sink on the same microprocessor that it was removed from, make sure that the following requirements are met:

- The thermal grease on the heat sink and microprocessor is not contaminated.
- Additional thermal grease is not added to the existing thermal grease on the heat sink and microprocessor.

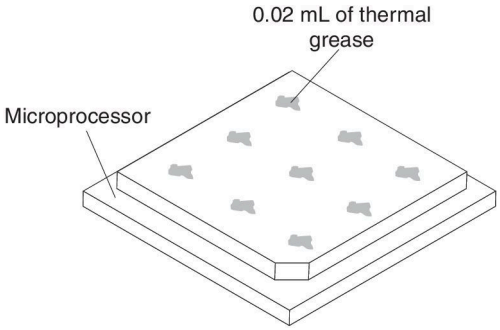
Notes:

- Read the safety information on page vii.
- Read the “Installation guidelines” on page 37.
- Read “Handling static-sensitive devices” on page 39.

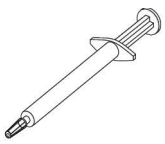
To replace damaged or contaminated thermal grease on the microprocessor and heat sink, complete the following steps:

1. Place the heat sink on a clean work surface.
2. Remove the cleaning pad from its package and unfold it completely.
3. Use the cleaning pad to wipe the thermal grease from the bottom of the heat sink.

   Note: Make sure that all of the thermal grease is removed.
4. Use a clean area of the cleaning pad to wipe the thermal grease from the microprocessor; then, dispose of the cleaning pad after all of the thermal grease is removed.



5. Use the thermal-grease syringe to place 9 uniformly spaced dots of 0.02 mL each on the top of the microprocessor. The outermost dots must be within approximately 5 mm of the edge of the microprocessor; this is to ensure uniform distribution of the grease.



Note: If the grease is properly applied, approximately half of the grease will remain in the syringe.

6. Install the heat sink onto the microprocessor as described in 11 on page 104.

If you have other options to install or remove, do so now. Otherwise, go to “Completing the installation” on page 109.

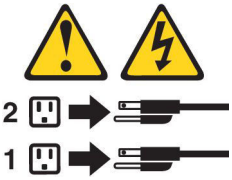
Installing a hot-swap power supply

The following notes describe the type of ac power supply that the server supports and other information that you must consider when you install a power supply:

- Make sure that the devices that you are installing are supported. For a list of supported optional devices for the server, see http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/.
- Before you install an additional power supply or replace a power supply with one of a different wattage, you may use the IBM Power Configurator utility to determine current system power consumption. For more information and to download the utility, go to http://www-03.ibm.com/systems/bladecenter/resources/powerconfig.html.
- The server comes with one hot-swap 12-volt output power supply that connects to power supply bay 1. The input voltage is 110 V ac or 220 V ac auto-sensing.
- Power supplies in the server must be with the same power rating or wattage to ensure that the server will operate correctly.
- Power supply 1 is the default/primary power supply. If power supply 1 fails, you must replace the power supply with the same wattage immediately.
- You can order an optional power supply for redundancy.
- These power supplies are designed for parallel operation. In the event of a power-supply failure, the redundant power supply continues to power the system. The server supports a maximum of two power supplies.

Statement 5:

CAUTION:
The power control button on the device and the power switch on the power supply do not turn off the electrical current supplied to the device. The device also might have more than one power cord. To remove all electrical current from the device, ensure that all power cords are disconnected from the power source.



Statement 8

CAUTION:
Never remove the cover on a power supply or any part that has the following label attached.

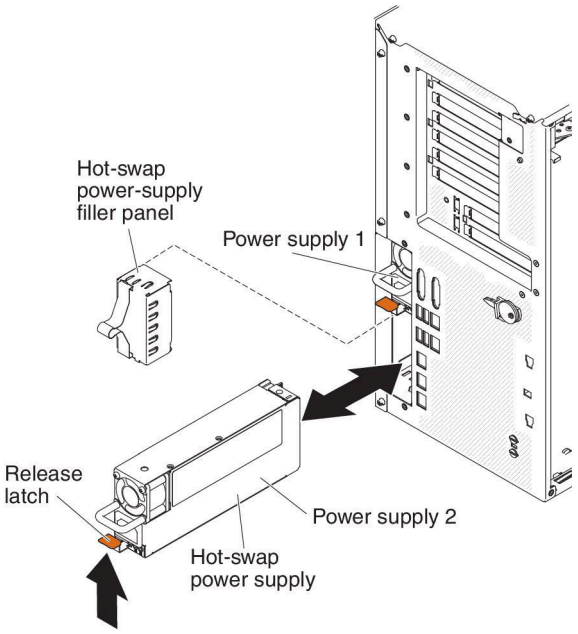
Hazardous voltage, current, and energy levels are present inside any component that has this label attached. There are no serviceable parts inside these components. If you suspect a problem with one of these parts, contact a service technician.

To install a hot-swap ac power supply, complete the following steps:

Note: You must install the fan cage assembly before removing or installing the power supply.

1. Read the safety information that begins vii and “Installation guidelines” on page 37.

   Attention: Static electricity that is released to internal server components when the server is powered-on might cause the server to halt, which might result in the loss of data. To avoid this potential problem, always use an electrostatic-discharge wrist strap or other grounding system when you work inside the server with the power on.
2. Touch the static-protective package that contains the hot-swap power supply to any unpainted metal surface on the server; then, remove the power supply from the package and place it on a static-protective surface.
3. Remove the power-supply filler panel from the power bay, if one is installed.



4. Install the power supply and push it in until it locks into place.

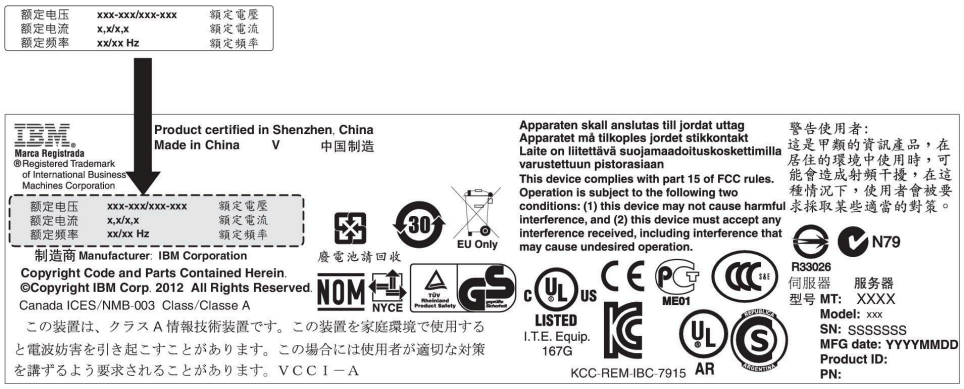
Notes:

a. If only one hot-swap power supply is installed in the server, a power-supply filler must be installed in the empty power bay.

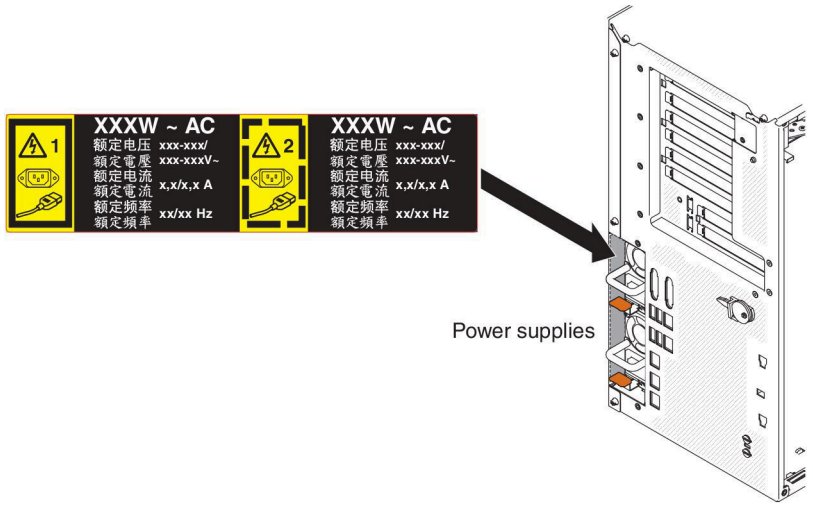
b. Do not mix power supplies with different wattage in the server.

5. Route the power cord through the handle and cable tie if any, so that it does not accidentally become unplugged.
6. Connect one end of the power cord for the new power supply into the connector on the back of the power supply; then, connect the other end of the power cord to a properly grounded electrical outlet.

   Note: If the server has been turned off, you must wait approximately 3 minutes after you connect the server power cord to an electrical outlet before the power-control button becomes active.
7. Make sure that the ac power LED and the dc power LED on the ac power supply are lit, indicating that the power supply is operating correctly. The two green LEDs are to the right of the power-cord connector.
8. If you are replacing a power supply with one of a different wattage, apply the power information label provided with the new power supply over the existing power information label on the server.



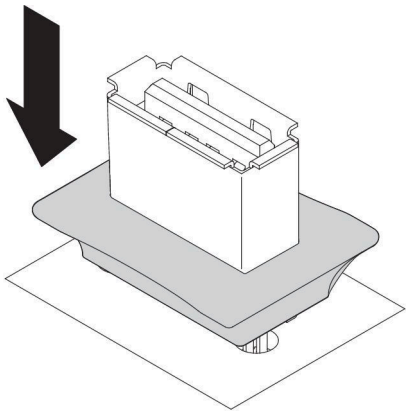
9. If you are adding a power supply to the server, attach the redundant power information label that comes with this option on the server cover near the power supplies.



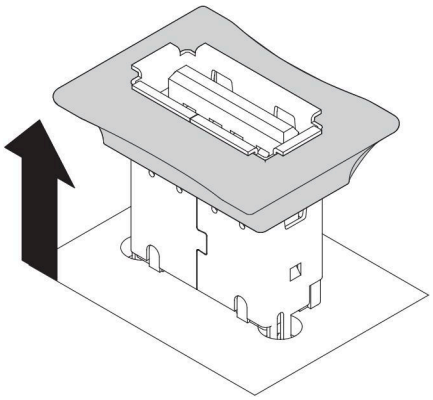
Installing a USB embedded hypervisor flash device

To install a hypervisor flash device, complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Turn off the server and peripheral devices and disconnect the power cords.
3. Remove the cover (see “Removing the left-side cover” on page 60).
4. Unlock the retention latch by pushing it down toward the system board.



5. Align the flash device with the USB connector on the system board and push it into the USB connector until it is firmly seated.
6. Return the retention latch to the locked position by pulling it away from the system board.



If you have other devices to install or remove, do so now. Otherwise, go to “Completing the installation.”

Completing the installation

To complete the installation, complete the following steps:

1. If you removed the fan cage assembly, reinstall it (see “Replacing the fan cage assembly” on page 110).
2. If you removed the air baffle, reinstall it (see “Replacing the air baffle” on page 112).
3. If you removed the server cover, replace it (see “Replacing the left-side cover” on page 113).

4. Reconnect the cables and power cords (see “Connecting the cables” on page 114).
5. Update the server configuration (see “Updating the server configuration” on page 115).
6. Install the server in the rack cabinet (see the *Tower to Rack Installation Instructions* that come with the server for instructions).
7. Slide the server back into the rack, if necessary.
8. Start the server. Confirm that it starts correctly and recognizes the newly installed devices, and make sure that no error LEDs are lit.
9. (IBM Business Partners only) Complete the additional steps in “Instructions for IBM Business Partners” on page 29.

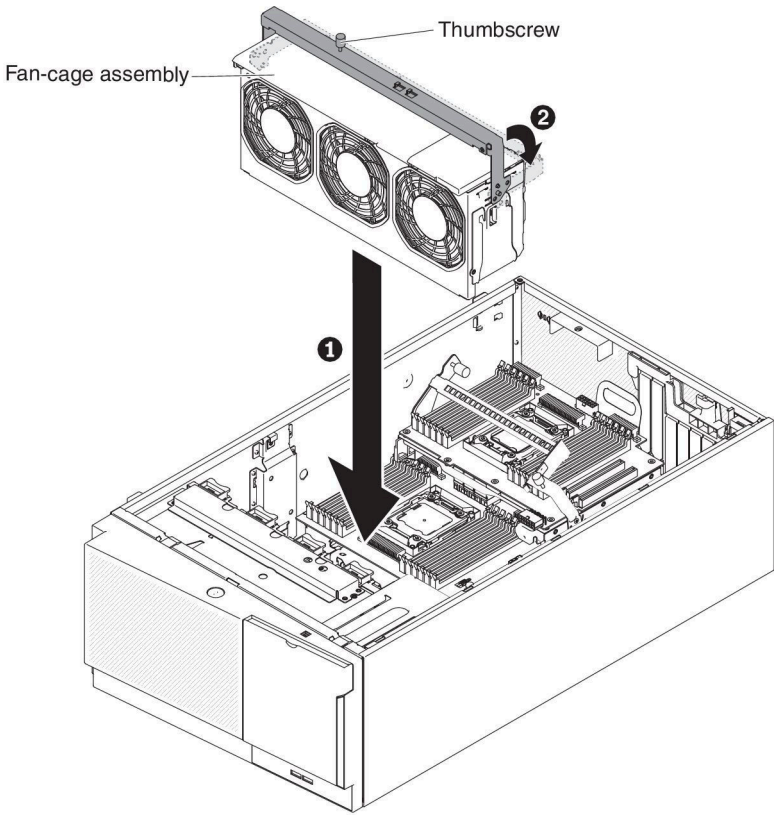
Replacing the fan cage assembly

To replace the fan cage assembly, complete the following steps.

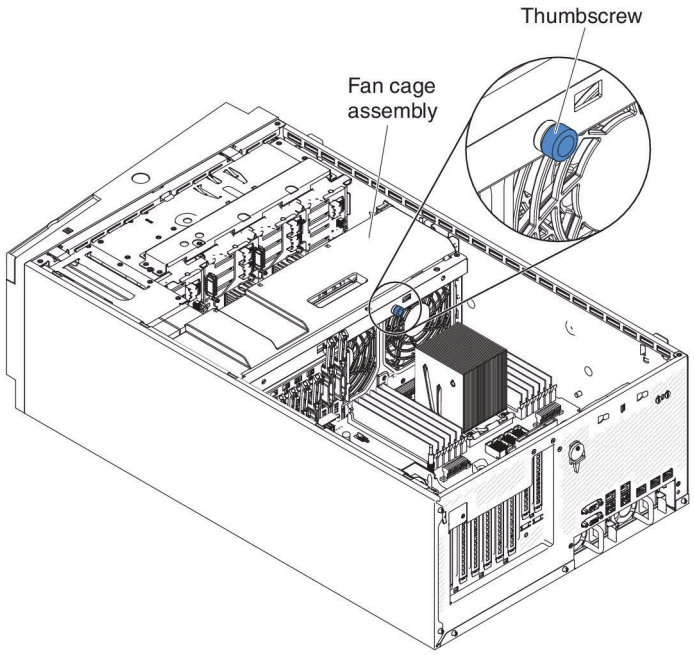
Attention: Make sure that all wires and cables inside the server are routed correctly before you install the fan cage assembly. Wiring that is not properly routed might be damaged or might prevent the fan cage assembly from seating properly in the server.

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Align the guides on the fan cage with the release latch to the open position on each side.
3. Push the fan cage assembly into the server.

   Note: Make sure that the fan cage is fully seated.
4. Rotate the fan cage release latch to the close position. The fan cage will be fully seated when it is secured.


Thumbscrew
Fan-cage assembly
2
1

5. Fasten the thumb screw on the fan cage release latch.



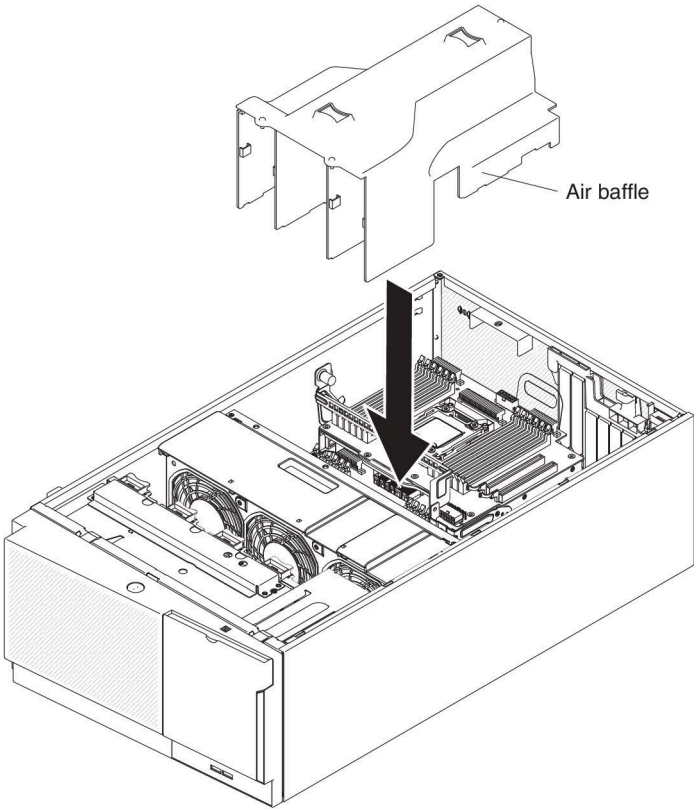
6. Connect the fan cage assembly power cable to the system board (see “Internal cable routing and connectors” on page 40).

Replacing the air baffle

Note: When you install the second microprocessor, you must also install fan 2 and the air baffle that come with the second microprocessor upgrade kit.

To replace the air baffle (two microprocessors installed), complete the following steps:

1. Read the safety information that begins on page vii and “Installation guidelines” on page 37.
2. Slide the air baffle down into the server until the positioning pins fit into the locating holes; then, press down on the air baffle until the pinch tab clicks into place.



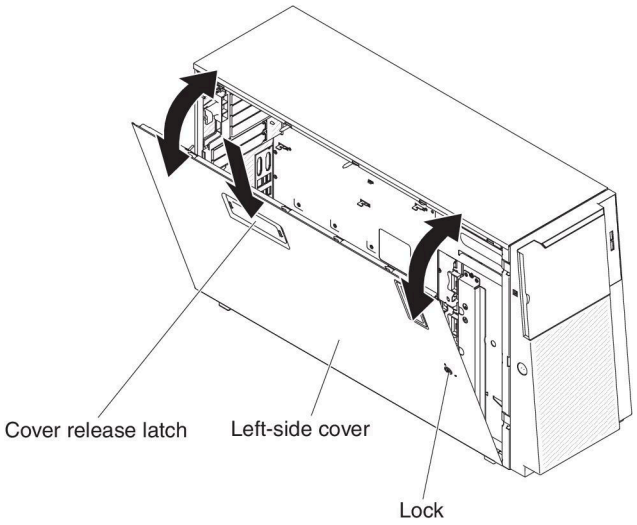
Replacing the left-side cover

To replace the left-side server cover, complete the following steps:

1. Make sure that all cables, adapters, and other components are installed and seated correctly and that you have not left loose tools or parts inside the server. Also, make sure that all internal cables are correctly routed.

   Important: Before you slide the cover forward, make sure that all the tabs on the front, rear, and side of the cover engage the chassis correctly. If all the tabs do not engage the chassis correctly, it will be very difficult to remove the cover later.

2. Set the bottom edge of the left-side cover on the bottom ledge of the server.



3. Rotate the top edge of the cover toward the server and press inward on the cover until it clicks into place.
4. Lock the cover, using the key that comes with the server.

Connecting the cables

The following illustrations show the locations of the input and output connectors on the front of the server.

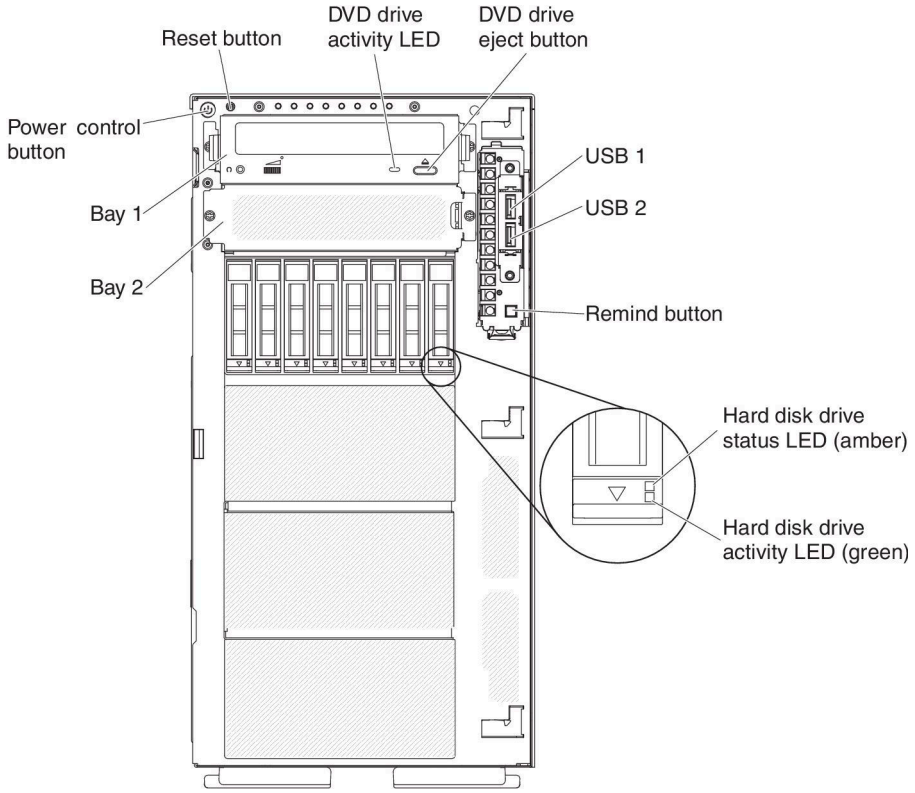


Figure 15. Front of server

The following illustration shows the locations of the input and output connectors on the rear of the server.

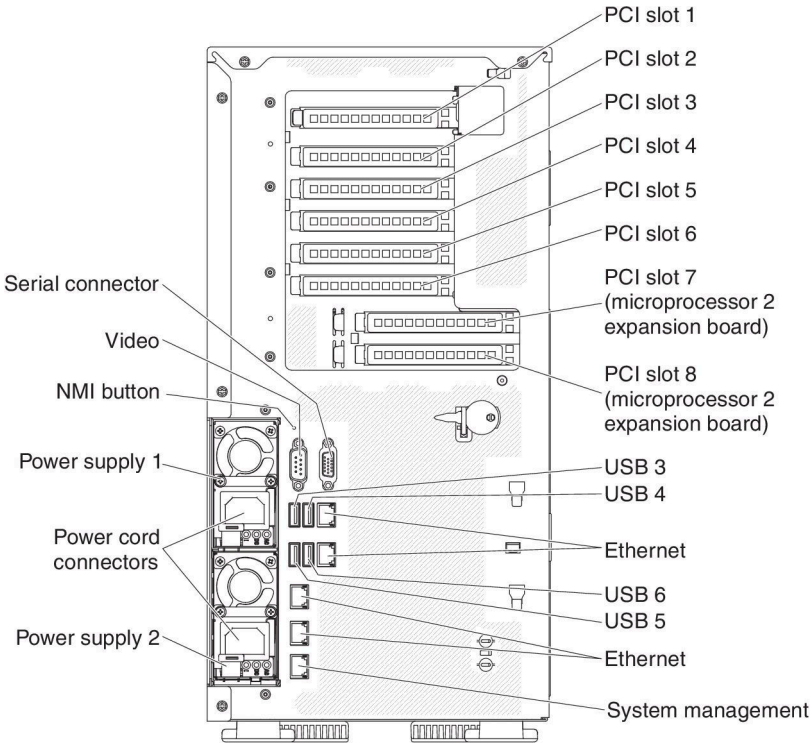


Figure 16. Rear of server

You must turn off the server before you connect or disconnect cables.

See the documentation that comes with any external devices for additional cabling instructions. It might be easier for you to route cables before you connect the devices to the server.

Updating the server configuration

When you start the server for the first time after you add or remove a device, you might receive a message that the configuration has changed. The Setup utility starts automatically so that you can save the new configuration settings.

Some optional devices have device drivers that you must install. For information about installing device drivers, see the documentation that comes with each device.

If the server has an optional RAID adapter and you have installed or removed a hard disk drive, see the documentation that comes with the RAID adapter for information about reconfiguring the disk arrays.

For information about configuring the Ethernet controller, see “Configuring the Ethernet controller” on page 130.

Chapter 3. Configuring the server

The following configuration programs come with the server:

- **Setup utility**

  The UEFI (formerly BIOS) Setup Utility program is part of the basic input/output system firmware. Use it to change interrupt request (IRQ) settings, change the startup-device sequence, set the date and time, and set passwords. For information about using this program, see “Using the Setup utility” on page 120.

- **Boot Manager program**

  The Boot Manager program is part of the server firmware. Use it to override the startup sequence that is set in the Setup utility and temporarily assign a device to be first in the startup sequence. For more information about using this program, see “Using the Boot Manager program” on page 126.

- **IBM *ServerGuide Setup and Installation* CD**

  The ServerGuide program provides software-setup tools and installation tools that are designed for the server. Use this CD during the installation of the server to configure basic hardware features, such as an integrated SAS/SATA controller with RAID capabilities, and to simplify the installation of your operating system. For information about using this CD, see “Using the ServerGuide Setup and Installation CD” on page 118.

- **Integrated Management Module II**

  Use the integrated management module II (IMM2) for configuration, to update the firmware and sensor data record/field replaceable unit (SDR/FRU) data, and to remotely manage a network. For information about using the IMM2, see “Using the Integrated Management Module II” on page 126.

- **VMware ESXi embedded hypervisor**

  The VMware ESXi embedded hypervisor is available on the server models that come with an installed USB embedded hypervisor flash device. The USB flash device is installed in the USB connector on the system board. Hypervisor is virtualization software that enables multiple operating systems to run on a host system at the same time. For more information about using the embedded hypervisor, see “Using the embedded hypervisor” on page 129.

- **Ethernet controller configuration**

  For information about configuring the Ethernet controller, see “Configuring the Ethernet controller” on page 130.

- **IBM Advanced Settings Utility (ASU) program**

  Use this program as an alternative to the Setup utility for modifying UEFI settings. Use the ASU program online or out of band to modify UEFI settings from the command line without the need to restart the server to access the Setup utility. For more information about using this program, see “IBM Advanced Settings Utility program” on page 131.

- **LSI Configuration Utility**

  Use the LSI Configuration Utility program to configure the integrated SAS/SATA controller with RAID capabilities and the devices that are attached to it. For information about using this program, see “Configuring RAID arrays” on page 131.

  The following table lists the server configurations and the applications that are available for configuring and managing RAID arrays.

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Table 10. Server configuration and applications for configuring and managing RAID arrays

Server configuration	RAID array configuration (before operating system is installed)	RAID array management (after operating system is installed)
ServeRAID-M1115 adapter	MegaRAID BIOS Configuration Utility (press Ctrl+H to start), pre-boot CLI (press Ctrl+P to start), ServerGuide, HII	MegaRAID Storage Manager (MSM), MegaCLI (Command Line Interface), and IBM Director
ServeRAID-M5110 adapter	MegaRAID BIOS Configuration Utility (press Ctrl+H to start), pre-boot CLI (press Ctrl+P to start), ServerGuide, HII	MegaRAID Storage Manager (MSM), MegaCLI, and IBM Director
ServeRAID-M5120 adapter	MegaRAID BIOS Configuration Utility (press Ctrl+H to start), pre-boot CLI (press Ctrl+P to start), ServerGuide, HII	MegaRAID Storage Manager (MSM), MegaCLI, and IBM Director

Notes:

1. For more information about the Human Interface Infrastructure (HII) and SAS2IRCU, go to http://www-947.ibm.com/support/entry/portal/docdisplay?lndocid=MIGR-5088601.
2. For more information about the MegaRAID, go to http://www-947.ibm.com/support/entry/portal/docdisplay?lndocid=MIGR-5073015.

Note: Do not install the ServeRAID M5120 SAS/SATA adapter in slot 4, 7, and 8 for proper cooling.

Using the ServerGuide Setup and Installation CD

The *ServerGuide Setup and Installation* CD provides software setup tools and installation tools that are designed for your server. The ServerGuide program detects the server model and hardware options that are installed and uses that information during setup to configure the hardware. Use this CD during the initial installation of the server to simplify the operating-system installations by providing updated device drivers and, in some cases, installing them automatically. To download the CD, go to http://www.ibm.com/support/entry/portal/docdisplay?lndocid=SERV-GUIDE and click **IBM Service and Support Site**.

Note: Changes are made periodically to the IBM website. The actual procedure might vary slightly from what is described in this document.

To start the *ServerGuide Setup and Installation* CD, complete the following steps:

1. Insert the CD, and restart the server. If the CD does not start, see “ServerGuide Problems” in the *Problem Determination and Service Guide* on the *System x Documentation* CD.
2. Follow the instructions on the screen to:
   a. Select your language.
   b. Select your keyboard layout and country.
   c. View the overview to learn about ServerGuide features.

d. View the readme file to review installation tips for your operating system and adapter.
e. Start the operating-system installation. You will need your operating-system CD.

The ServerGuide program has the following features:

- An easy-to-use interface
- Diskette-free setup, and configuration programs that are based on detected hardware
- ServeRAID Manager program, which configures your ServeRAID adapter
- Device drivers that are provided for your server model and detected hardware
- Operating-system partition size and file-system type that are selectable during setup

Note: Features and functions can vary slightly with different versions of the ServerGuide program.

ServerGuide features

Features and functions can vary slightly with different versions of the ServerGuide program. To learn more about the version that you have, start the *ServerGuide Setup and Installation* CD and view the online overview. Not all features are supported on all server models.

The ServerGuide program requires a supported IBM server with an enabled startable (bootable) CD drive. In addition to the *ServerGuide Setup and Installation* CD, you must have your operating-system CD to install the operating system.

The ServerGuide program performs the following tasks:

- Sets system date and time
- Detects the RAID adapter or controller and runs the SAS/SATA RAID configuration program
- Checks the microcode (firmware) levels of a ServeRAID adapter and determines whether a later level is available from the CD
- Detects installed hardware options and provides updated device drivers for most adapters and devices
- Provides diskette-free installation for supported Windows operating systems
- Includes an online readme file with links to tips for your hardware and operating-system installation

Setup and configuration overview

When you use the *ServerGuide Setup and Installation* CD, you do not need setup diskettes. You can use the CD to configure any supported IBM server model. The setup program provides a list of tasks that are required to set up your server model. On a server with a ServeRAID adapter or SAS/SATA controller with RAID capabilities, you can run the SAS/SATA RAID configuration program to create logical drives.

Important: Before you install a legacy operating system (such as VMware) on a server with an LSI SAS controller, you must first complete the following steps:

1. Update the device driver for the LSI SAS controller to the latest level.
2. In the Setup utility, set **Legacy Only** as the first option in the boot sequence in the **Boot Manager** menu.
3. Using the LSI Configuration Utility program, select a boot drive.

For detailed information and instructions, go to https://www-947.ibm.com/systems/support/supportsite.wss/docdisplay?lndocid=MIGR-5083225.

Typical operating-system installation

The ServerGuide program can reduce the time it takes to install an operating system. It provides the device drivers that are required for your hardware and for the operating system that you are installing. This section describes a typical ServerGuide operating-system installation.

Note: Features and functions can vary slightly with different versions of the ServerGuide program.

1. After you have completed the setup process, the operating-system installation program starts. (You will need your operating-system CD to complete the installation.)
2. The ServerGuide program stores information about the server model, service processor, hard disk drive controllers, and network adapters. Then, the program checks the CD for newer device drivers. This information is stored and then passed to the operating-system installation program.
3. The ServerGuide program presents operating-system partition options that are based on your operating-system selection and the installed hard disk drives.
4. The ServerGuide program prompts you to insert your operating-system CD and restart the server. At this point, the installation program for the operating system takes control to complete the installation.

Installing your operating system without using ServerGuide

If you have already configured the server hardware and you are not using the ServerGuide program to install your operating system, complete the following steps to download the latest operating-system installation instructions from the IBM website.

Note: Changes are made periodically to the IBM website. The actual procedure might vary slightly from what is described in this document.

1. Go to http://www.ibm.com/supportportal/.
2. Under **Product support**, click **System x**.
3. From the menu on the left side of the page, click **System x support search**.
4. From the **Task** menu, select **Install**.
5. From the **Product family** menu, select **System x3500 M4**.
6. From the **Operating system** menu, select your operating system, and then click **Search** to display the available installation documents.

Using the Setup utility

Use the Unified Extensible Firmware Interface (UEFI), formerly BIOS, Setup Utility program to perform the following tasks:

- View configuration information
- View and change assignments for devices and I/O ports
- Set the date and time
- Set the startup characteristics of the server and the order of startup devices
- Set and change settings for advanced hardware features
- View, set, and change settings for power-management features
- View and clear error logs

- Change interrupt request (IRQ) settings
- Resolve configuration conflicts

Starting the Setup utility

To start the Setup utility, complete the following steps:

1. Turn on the server.

   Note: Approximately 5 to 10 seconds after the server is connected to power, the power-control button becomes active.

2. When the prompt <F1> Setup is displayed, press F1. If you have set an administrator password, you must type the administrator password to access the full Setup utility menu. If you do not type the administrator password, a limited Setup utility menu is available.
3. Select settings to view or change.

Setup utility menu choices

The following choices are on the Setup utility main menu for the UEFI. Depending on the version of the firmware, some menu choices might differ slightly from these descriptions.

- **System Information**

  Select this choice to view information about the server. When you make changes through other choices in the Setup utility, some of those changes are reflected in the system information; you cannot change settings directly in the system information. This choice is on the full Setup utility menu only.

  – **System Summary**

    Select this choice to view configuration information, including the ID, speed, and cache size of the microprocessors, machine type and model of the server, the serial number, the system UUID, and the amount of installed memory. When you make configuration changes through other options in the Setup utility, the changes are reflected in the system summary; you cannot change settings directly in the system summary.

  – **Product Data**

    Select this choice to view the system-board identifier, the revision level or issue date of the firmware, the integrated management module and diagnostics code, and the version and date.

  This choice is on the full Setup utility menu only.

- **System Settings**

  Select this choice to view or change the server component settings.

  – **Processors**

    Select this choice to view or change the processor settings.

  – **Memory**

    Select this choice to view or change the memory settings.

  – **Devices and I/O Ports**

    Select this choice to view or change assignments for devices and input/output (I/O) ports. You can configure the serial ports, configure remote console redirection, enable or disable integrated Ethernet controllers, the SAS/SATA controllers, SATA optical drive channels, PCI slots, and video controller. If you disable a device, it cannot be configured, and the operating system will not be able to detect it (this is equivalent to disconnecting the device).

  – **Power**

Select this choice to view or change power capping to control consumption, processors, and performance states.

– **Operating Modes**

  Select this choice to view or change the operating profile (performance and power utilization).

– **Legacy Support**

  Select this choice to view or set legacy support.

  - **Force Legacy Video on Boot**

    Select this choice to force INT video support, if the operating system does not support UEFI video output standards.

  - **Rehook INT 19h**

    Select this choice to enable or disable devices from taking control of the boot process. The default is **Disable**.

  - **Legacy Thunk Support**

    Select this choice to enable or disable UEFI to interact with PCI mass storage devices that are non-UEFI compliant.

– **Integrated Management Module**

  Select this choice to view or change the settings for the integrated management module.

  - **POST Watchdog Timer**

    Select this choice to view or enable the POST watchdog timer.

  - **POST Watchdog Timer Value**

    Select this choice to view or set the POST loader watchdog timer value.

  - **Reboot System on NMI**

    Enable or disable restarting the system whenever a nonmaskable interrupt (NMI) occurs. **Disabled** is the default.

  - **Commands on USB Interface Preference**

    Select this choice to enable or disable the Ethernet over USB interface on IMM2.

  - **Network Configuration**

    Select this choice to view the system management network interface port, the IMM2 MAC address, the current IMM2 IP address, and the host name; define the static IMM2 IP address, subnet mask, and gateway address; specify whether to use the static IP address or have DHCP assign the IMM2 IP address; save the network changes; and reset the IMM2.

  - **Reset IMM2 to Defaults**

    Select this choice to view or reset IMM2 to the default settings.

  - **Reset IMM2**

    Select this choice to reset IMM2.

– **System Security**

  Select this choice to view or configure Trusted Platform Module (TPM) support.

– **Adapters and UEFI Drivers**

  Select this choice to view information about the UEFI 1.10 and UEFI 2.0 compliant adapters and drivers installed in the server.

– **Video**

  Select this choice to view or configure the video device options.

Note: The configuration forms for UEFI 2.1 and greater compliant add-on video devices might be located here.

- **Date and Time**

  Select this choice to set the date and time in the server, in 24-hour format (*hour*:*minute*:*second*).

  This choice is on the full Setup utility menu only.

- **Start Options**

  Select this choice to view or change the start options, including the startup sequence, keyboard NumLock state, PXE boot option, and PCI device boot priority. Changes in the startup options take effect when you start the server.

  The startup sequence specifies the order in which the server checks devices to find a boot record. The server starts from the first boot record that it finds. If the server has Wake on LAN hardware and software and the operating system supports Wake on LAN functions, you can specify a startup sequence for the Wake on LAN functions. For example, you can define a startup sequence that checks for a disc in the CD-RW/DVD drive, then checks the hard disk drive, and then checks a network adapter.

  This choice is on the full Setup utility menu only.

- **Boot Manager**

  Select this choice to view, add, delete, or change the device boot priority, boot from a file, select a one-time boot, or reset the boot order to the default setting.

- **System Event Logs**

  Select this choice to enter the System Event Manager, where you can view the error messages in the system event logs. You can use the arrow keys to move between pages in the error log.

  The system event logs contain all event and error messages that have been generated during POST, by the systems-management interface handler, and by the system service processor. Run the diagnostic programs to get more information about error codes that occur. See the *Problem Determination and Service Guide* on the IBM *System x Documentation* CD for instructions for running the diagnostic programs.

  Important: If the system-error LED on the front of the server is lit but there are no other error indications, clear the IMM2 system-event log. Also, after you complete a repair or correct an error, clear the IMM2 system-event log to turn off the system-error LED on the front of the server.

  – **POST Event Viewer**

    Select this choice to enter the POST event viewer to view the POST error messages.

  – **System Event Log**

    Select this choice to view the IMM2 system event log.

  – **Clear System Event Log**

    Select this choice to clear the IMM2 system event log.

- **User Security**

  Select this choice to set, change, or clear passwords. See “Passwords” on page 124 for more information.

  This choice is on the full and limited Setup utility menu.

  – **Set Power-on Password**

    Select this choice to set or change a power-on password. For more information, see “Power-on password” on page 124 for more information.

  – **Clear Power-on Password**

Select this choice to clear a power-on password. For more information, see "Power-on password" for more information.

  - **Set Administrator Password**

    Select this choice to set or change an administrator password. An administrator password is intended to be used by a system administrator; it limits access to the full Setup utility menu. If an administrator password is set, the full Setup utility menu is available only if you type the administrator password at the password prompt. For more information, see "Administrator password" on page 126.

  - **Clear Administrator Password**

    Select this choice to clear an administrator password. For more information, see "Administrator password" on page 126.

- **Save Settings**

  Select this choice to save the changes that you have made in the settings.

- **Restore Settings**

  Select this choice to cancel the changes that you have made in the settings and restore the previous settings.

- **Load Default Settings**

  Select this choice to cancel the changes that you have made in the settings and restore the factory settings.

- **Exit Setup**

  Select this choice to exit from the Setup utility. If you have not saved the changes that you have made in the settings, you are asked whether you want to save the changes or exit without saving them.

Passwords

From the **User Security** menu choice, you can set, change, and delete a power-on password and an administrator password. The **User Security** choice is on the full Setup utility menu only.

If you set only a power-on password, you must type the power-on password to complete the system startup and to have access to the full Setup utility menu.

An administrator password is intended to be used by a system administrator; it limits access to the full Setup utility menu. If you set only an administrator password, you do not have to type a password to complete the system startup, but you must type the administrator password to access the Setup utility menu.

If you set a power-on password for a user and an administrator password for a system administrator, you must type the power-on password to complete the system startup. A system administrator who types the administrator password has access to the full Setup utility menu; the system administrator can give the user authority to set, change, and delete the power-on password. A user who types the power-on password has access to only the limited Setup utility menu; the user can set, change, and delete the power-on password, if the system administrator has given the user that authority.

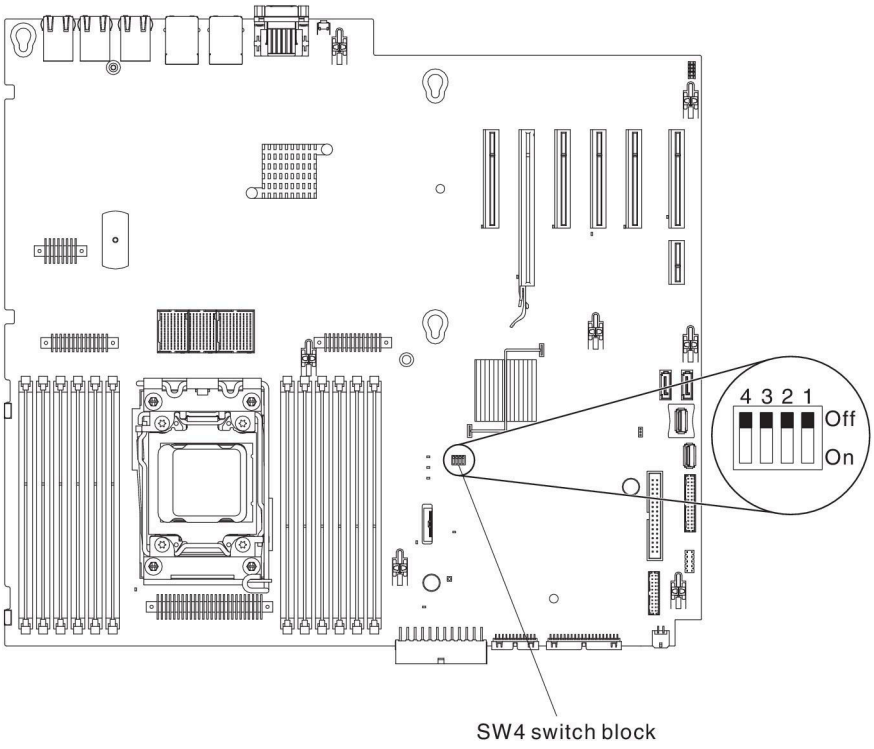
Power-on password

If a power-on password is set, when you turn on the server, you must type the power-on password to complete the system startup. You can use any combination of 6 - 20 printable ASCII characters for the password.

When a power-on password is set, you can enable the Unattended Start mode, in which the keyboard and mouse remain locked but the operating system can start. You can unlock the keyboard and mouse by typing the power-on password.

If you forget the power-on password, you can regain access to the server in any of the following ways:

- If an administrator password is set, type the administrator password at the password prompt. Start the Setup utility and reset the power-on password.
- Remove the battery from the server and then reinstall it. See the *Problem Determination and Service Guide* on the IBM *System x Documentation* CD for instructions for removing the battery.
- Change the position of the power-on password switch (enable switch 3 of the system board switch block (SW4) to bypass the password check (see "System-board switches and jumpers" on page 32 for more information).



Attention: Before you change any switch settings or move any jumpers, turn off the server; then, disconnect all power cords and external cables. See the safety information that begins on page vii. Do not change settings or move jumpers on any system-board switch or jumper block that is not shown in this document.

The default for all of the switches on switch block (SW4) is Off.

While the server is turned off, move switch 3 of the switch block (SW4) to the On position to enable the power-on password override. You can then start the Setup utility and reset the power-on password. You do not have to return the switch to the previous position.

The power-on password override switch does not affect the administrator password.

Administrator password

If an administrator password is set, you must type the administrator password for access to the full Setup utility menu. You can use any combination of 6 - 20 printable ASCII characters for the password.

Attention: If you set an administrator password and then forget it, there is no way to change, override, or remove it. You must replace the system board.

Using the Boot Manager program

The Boot Manager program is a built-in, menu-driven configuration utility program that you can use to temporarily redefine the first startup device without changing settings in the Setup utility.

To use the Boot Manager program, complete the following steps:

1. Turn off the server.
2. Restart the server.
3. When the prompt `<F12> Select Boot Device` is displayed, press F12. If a bootable USB mass storage device is installed, a submenu item (**USB Key/Disk**) is displayed.
4. Use the Up arrow and Down arrow keys to select an item from the **Boot Selection Menu** and press **Enter**.

The next time the server starts, it returns to the startup sequence that is set in the Setup utility.

Starting the backup server firmware

The system board contains a backup copy area for the server firmware. This is a secondary copy of the server firmware that you update only during the process of updating the server firmware. If the primary copy of the server firmware becomes damaged, use this backup copy.

To force the server to start from the backup copy, turn off the server; then, place the JP2 jumper in the backup position (pins 2 and 3).

Use the backup copy of the server firmware until the primary copy is restored. After the primary copy is restored, turn off the server; then, move the JP2 jumper back to the primary position (pins 1 and 2).

Using the Integrated Management Module II

The integrated management module II (IMM2) is the second generation of the IMM. Unlike the first generation of IMM, the IMM2 has three levels of firmware: basic, standard, and premium. The level of IMM2 firmware in your server depends on the server platform. IMM2 basic firmware provides server management through the Intelligent Platform Management Interface (IPMI). IMM2 standard firmware provides basic functionality plus the ability to manage servers through other user interfaces, such as the web, Telnet, Secure Shell (SSH), and Simple Network Management Protocol (SNMP). IMM2 premium firmware provides standard functionality plus remote-presence capability.

Some servers that come with IMM2 basic or standard firmware might have an option to upgrade the IMM2 firmware to a higher level. If you add the service processor upgrade option to IMM2 basic firmware, the result is IMM2 standard

functionality. If you add the remote presence upgrade option to IMM2 standard firmware, the result is IMM2 premium functionality.

Note: You cannot upgrade IMM2 basic firmware directly to IMM2 premium firmware by using the remote presence upgrade option. You must use the service processor upgrade option to upgrade to IMM2 standard firmware and then use the remote presence upgrade option to upgrade to IMM2 premium firmware.

For more information about the IMM2, see the Integrated Management Module II User's Guide at http://www-947.ibm.com/support/entry/portal/docdisplay?brand=5000008&lndocid=MIGR-5086346.

The IMM2 supports the following basic systems-management features:

- Environmental monitor with fan speed control for temperature, voltages, fan failure, and power supply failure.
- DIMM error assistance. The Unified Extensible Firmware Interface (UEFI) disables a failing DIMM that is detected during POST, and the IMM2 lights the associated system error LED and the failing DIMM error LED.
- System-event log (SEL).
- ROM-based IMM2 firmware flash updates.
- Auto Boot Failure Recovery (ABR).
- Nonmaskable interrupt (NMI) detection and reporting.
- Automatic Server Restart (ASR) when POST is not complete or the operating system hangs and the operating system watchdog timer times-out. The IMM2 might be configured to watch for the operating system watchdog timer and reboot the system after a timeout, if the ASR feature is enabled. Otherwise, the IMM2 allows the administrator to generate a nonmaskable interrupt (NMI) by pressing an NMI button on the system board for an operating-system memory dump. ASR is supported by IPMI.
- Intelligent Platform Management Interface (IPMI) Specification V2.0 and Intelligent Platform Management Bus (IPMB) support.
- Invalid system configuration (CNFG) LED support.
- Serial over LAN (SOL).
- PECI 2 support.
- Power/reset control (power-on, hard and soft shutdown, hard and soft reset, schedule power control).
- Alerts (in-band and out-of-band alerting, PET traps - IPMI style, SNMP, e-mail).
- Operating-system failure blue screen capture.
- Configuration save and restore.
- PCI configuration data.
- Boot sequence manipulation.

The IMM2 also provides the following remote server management capabilities through the OSA SMBridge management utility program:

- **Command-line interface (IPMI Shell)**

  The command-line interface provides direct access to server management functions through the IPMI 2.0 protocol. Use the command-line interface to issue commands to control the server power, view system information, and identify the server. You can also save one or more commands as a text file and run the file as a script.

- **Serial over LAN**

  Establish a Serial over LAN (SOL) connection to manage servers from a remote location. You can remotely view and change the UEFI settings, restart the server, identify the server, and perform other management functions. Any standard Telnet client application can access the SOL connection.

Obtaining the IP address for the IMM2

To access the web interface, you need the IP address for IMM2. You can obtain the IMM2 IP address through the Setup utility. The server comes with a default IP address for the IMM2 of 192.168.70.125. To locate the IP address, complete the following steps:

1. Turn on the server.

   Note: Approximately 5 to 10 seconds after the server is connected to power, the power-control button becomes active.
2. When the prompt `<F1> Setup` is displayed, press F1. (This prompt is displayed on the screen for only a few seconds. You must press F1 quickly.) If you have set both a power-on password and an administrator password, you must type the administrator password to access the full Setup utility menu.
3. From the Setup utility main menu, select **System Settings**.
4. On the next screen, select **Integrated Management Module**.
5. On the next screen, select **Network Configuration**.
6. Find the IP address and write it down.
7. Exit from the Setup utility.

Logging on to the web interface

To log onto the web interface to use the remote presence functions, complete the following steps:

1. Open a web browser on a computer that connects to the server and in the **address** or **URL** field, type the IP address or host name of the IMM to which you want to connect.

   Note: The IMM2 defaults to DHCP. If a DHCP host is not available, the IMM2 assigns a static IP address of 192.168.70.125.
2. On the Login page, type the user name and password. If you are using the IMM for the first time, you can obtain the user name and password from your system administrator. All login attempts are documented in the event log.

   Note: The IMM2 is set initially with a user name of USERID and password of PASSW0RD (passw0rd with a zero, not the letter O). You have read/write access. You must change the default password the first time you log on.
3. On the Welcome page, type a timeout value (in minutes) in the field that is provided. The IMM2 will log you off of the web interface if your browser is inactive for the number of minutes that you entered for the timeout value.
4. Click **Continue** to start the session. The System Health page provides a quick view of the system status.

Using the remote presence capability and blue-screen capture

The remote presence and blue-screen capture features are integrated functions of the Integrated Management Module II (IMM2). When the optional IBM Integrated Management Module Advanced Upgrade is installed in the server, it activates the

remote presence functions. The Integrated Management Module Advanced Upgrade is required to enable the integrated remote presence and blue-screen capture features. Without the Integrated Management Module Advanced Upgrade, you will not be able to access the network remotely to mount or unmount drives or images on the client system. However, you can still access the web interface without the upgrade.

After the Integrated Management Module Advanced Upgrade is installed in the server, it is authenticated to determine whether it is valid. If the key is not valid, you receive a message from the web interface (when you attempt to start the remote presence feature) indicating that the Integrated Management Module Advanced Upgrade is required to use the remote presence feature.

The remote presence feature provides the following functions:

- Remotely viewing video with graphics resolutions up to 1600 x 1200 at 75 Hz, regardless of the system state
- Remotely accessing the server, using the keyboard and mouse from a remote client
- Mapping the CD or DVD drive, diskette drive, and USB flash drive on a remote client, and mapping ISO and diskette image files as virtual drives that are available for use by the server
- Uploading a diskette image to the IMM memory and mapping it to the server as a virtual drive

The blue-screen capture feature captures the video display contents before the IMM restarts the server when the IMM detects an operating-system hang condition. A system administrator can use the blue-screen capture to assist in determining the cause of the hang condition.

Enabling the remote presence feature

To enable the remote presence feature, complete the following steps:

1. Install the Integrated Management Module Advanced Upgrade.
2. Turn on the server.

   Note: Approximately 20 to 40 seconds after the server is connected to power, the power-control button becomes active.

Reactivate any Features on Demand features after replacing the system board. Instructions for automating the activation of features and installing activation keys is in the *IBM Features on Demand User's Guide*. To download the document, go to http://www.ibm.com/systems/x/fod/, log in, and click **Help**.

Using the embedded hypervisor

The VMware ESXi embedded hypervisor software is available on the optional IBM USB flash device with embedded hypervisor. Hypervisor is virtualization software that enables multiple operating systems to run on a host system at the same time. The USB flash device is required to activate the hypervisor functions.

To start using the embedded hypervisor functions, you must add the USB flash device to the startup sequence in the Setup utility.

To add the USB flash device to the startup sequence, complete the following steps:

1. Turn on the server.

Note: Approximately 5 to 10 seconds after the server is connected to power, the power-control button becomes active.

2. When the prompt <F1> Setup is displayed, press F1.
3. From the Setup utility main menu, select **Boot Manager**.
4. Select **Add Boot Option**; then, select **Generic Boot Option** and **Embedded Hypervisor**. Press Enter, and then select Esc.
5. Select **Change Boot Order** and then select **Change the order**. Use the Up arrow and Down Arrow keys to select Embedded Hypervisor and use the plus (+) and minus (-) keys to move Embedded Hypervisor in the boot order. When **Embedded Hypervisor** is in the correct location in the boot order, press Enter. Select **Commit Changes** and press Enter.
6. Select **Save Settings** and then select **Exit Setup**.

If the embedded hypervisor flash device image becomes corrupt, you can download the image from http://www-03.ibm.com/systems/x/os/vmware/esxi/.

For additional information and instructions, see VMware vSphere 4.1 Documentation at http://www.vmware.com/support/pubs/vs_pages/vsp_pubs_esxi41_e_vc41.html or the *VMware vSphere Installation and Setup Guide* at http://pubs.vmware.com/vsphere-50/topic/com.vmware.ICbase/PDF/vsphere-esxi-vcenter-server-50-installation-setup-guide.pdf.

Configuring the Ethernet controller

The Ethernet controllers are integrated on the system board. They provide an interface for connecting to a 10 Mbps, 100 Mbps, or 1 Gbps network and provide full-duplex (FDX) capability, which enables simultaneous transmission and reception of data on the network. If the Ethernet ports in the server support auto-negotiation, the controllers detect the data-transfer rate (10BASE-T, 100BASE-TX, or 1000BASE-T) and duplex mode (full-duplex or half-duplex) of the network and automatically operate at that rate and mode.

You do not have to set any jumpers or configure the controllers. However, you must install a device driver to enable the operating system to address the controllers.

To find device drivers and information about configuring the Ethernet controllers, go to http://www.ibm.com/supportportal/.

Enabling Features on Demand Ethernet software

You can activate the Features on Demand (FoD) software upgrade key for Fibre Channel over Ethernet (FCoE) and iSCSI storage protocols that is integrated in the integrated management module. For more information and instructions for activating the Features on Demand Ethernet software key, see the *IBM Features on Demand User's Guide*. To download the document, go to http://www.ibm.com/systems/x/fod/, log in, and click **Help**.

Enabling Features on Demand RAID software

Integrated into the integrated management module is a Features on Demand RAID software upgrade key that you can activate to get support for RAID levels 5 and 50 or 6 and 60 (depending on the Features on Demand key). For more information and instructions for activating the Features on Demand RAID software key, see the *IBM*

Features on Demand User's Guide. To download the document, go to http://www.ibm.com/systems/x/fod/, log in, and click **Help**.

Configuring RAID arrays

Through the Setup utility, you can access utilities to configure RAID arrays. The specific procedure for configuring arrays depends on the RAID controller that you are using. For details, see the documentation for your RAID controller. To access the utility for your RAID controller, complete the following steps:

1. Turn on the server.

   Note: Approximately 10 seconds after the server is connected to power, the power-control button becomes active.
2. When prompted, <F1 Setup> is displayed, press F1. If you have set an administrator password, you must type the administrator password to access the full Setup utility menu. If you do not type the administrator password, a limited Setup utility menu is available.
3. Select **System Settings → Storage**.
4. Press Enter to refresh the list of device drivers.
5. Select the device driver for your RAID controller and press Enter.
6. Follow the instructions in the documentation for your RAID controller.

IBM Advanced Settings Utility program

The IBM Advanced Settings Utility (ASU) program is an alternative to the Setup utility for modifying UEFI settings. Use the ASU program online or out of band to modify UEFI settings from the command line without the need to restart the system to access the Setup utility.

You can also use the ASU program to configure the optional remote presence features or other IMM2 settings. The remote presence features provide enhanced systems-management capabilities.

In addition, the ASU program provides limited settings for configuring the IPMI function in the IMM2 through the command-line interface.

Use the command-line interface to issue setup commands. You can save any of the settings as a file and run the file as a script. The ASU program supports scripting environments through a batch-processing mode.

For more information and to download the ASU program, go to http://www.ibm.com/support/entry/portal/docdisplay?lndocid=TOOL-ASU.

Updating IBM Systems Director

If you plan to use IBM Systems Director to manage the server, you must check for the latest applicable IBM Systems Director updates and interim fixes.

Note: Changes are made periodically to the IBM website. The actual procedure might vary slightly from what is described in this document.

To locate and install a newer version of IBM Systems Director, complete the following steps:

1. Check for the latest version of IBM Systems Director:

a. Go to http://www.ibm.com/systems/software/director/downloads/index.html.
b. If a newer version of IBM Systems Director than what comes with the server is shown in the drop-down list, follow the instructions on the web page to download the latest version.

2. Install the IBM Systems Director program.

If your management server is connected to the Internet, to locate and install updates and interim fixes, complete the following steps:

1. Make sure that you have run the Discovery and Inventory collection tasks.
2. On the Welcome page of the IBM Systems Director web interface, click **View updates**.
3. Click **Check for updates**. The available updates are displayed in a table.
4. Select the updates that you want to install, and click **Install** to start the installation wizard.

If your management server is not connected to the Internet, to locate and install updates and interim fixes, complete the following steps:

1. Make sure that you have run the Discovery and Inventory collection tasks.
2. On a system that is connected to the Internet, go to http://www.ibm.com/support/fixcentral/.
3. From the **Product family** list, select **IBM Systems Director**.
4. From the **Product** list, select **IBM Systems Director**.
5. From the **Installed version** list, select the latest version, and click **Continue**.
6. Download the available updates.
7. Copy the downloaded files to the management server.
8. On the management server, on the Welcome page of the IBM Systems Director web interface, click the **Manage** tab, and click **Update Manager**.
9. Click **Import updates** and specify the location of the downloaded files that you copied to the management server.
10. Return to the Welcome page of the web interface, and click **View updates**.
11. Select the updates that you want to install, and click **Install** to start the installation wizard.

The Update*Xpress* System Pack Installer

The Update*Xpress* System Pack Installer detects supported and installed device drivers and firmware in the server and installs available updates. For additional information and to download the Update*Xpress* System Pack Installer, go to the System x and BladeCenter Tools Center at http://publib.boulder.ibm.com/infocenter/toolsctr/v1r0/index.jsp and click **UpdateXpress System Pack Installer**.

Appendix A. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. Use this information to obtain additional information about IBM and IBM products, determine what to do if you experience a problem with your IBM system or optional device, and determine whom to call for service, if it is necessary.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Check for updated firmware and operating-system device drivers for your IBM product. The IBM Warranty terms and conditions state that you, the owner of the IBM product, are responsible for maintaining and updating all software and firmware for the product (unless it is covered by an additional maintenance contract). Your IBM service technician will request that you upgrade your software and firmware if the problem has a documented solution within a software upgrade.
- If you have installed new hardware or software in your environment, check http://www.ibm.com/systems/info/x86servers/serverproven/compat/us/ to make sure that the hardware and software is supported by your IBM product.
- Go to http://www.ibm.com/supportportal/ to check for information to help you solve the problem.
- Gather the following information to provide to IBM Support. This data will help IBM Support quickly provide a solution to your problem and ensure that you receive the level of service for which you might have contracted.
  - Hardware and Software Maintenance agreement contract numbers, if applicable
  - Machine type number (IBM 4-digit machine identifier)
  - Model number
  - Serial number
  - Current system UEFI and firmware levels
  - Other pertinent information such as error messages and logs
- Go to http://www.ibm.com/support/entry/portal/Open_service_request/ to submit an Electronic Service Request. Submitting an Electronic Service Request will start the process of determining a solution to your problem by making the pertinent information available to IBM Support quickly and efficiently. IBM service technicians can start working on your solution as soon as you have completed and submitted an Electronic Service Request.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the documentation that is provided with your IBM product. The documentation that comes with IBM systems also describes the diagnostic tests that you can perform. Most systems, operating systems, and programs come with documentation that

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contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

Using the documentation

Information about your IBM system and preinstalled software, if any, or optional device is available in the documentation that comes with the product. That documentation can include printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to http://www.ibm.com/supportportal/. Also, some documents are available through the IBM Publications Center at http://www.ibm.com/shop/publications/order/.

Getting help and information from the World Wide Web

On the World Wide Web, up-to-date information about IBM systems, optional devices, services, and support is available at http://www.ibm.com/supportportal/. The address for IBM System x® information is http://www.ibm.com/systems/x/. The address for IBM BladeCenter® information is http://www.ibm.com/systems/bladecenter/. The address for IBM IntelliStation® information is http://www.ibm.com/systems/intellistation/.

How to send Dynamic System Analysis data to IBM

Use the IBM Enhanced Customer Data Repository to send diagnostic data to IBM. Before you send diagnostic data to IBM, read the terms of use at http://www.ibm.com/de/support/ecurep/terms.html.

You can use any of the following methods to send diagnostic data to IBM:

- **Standard upload:** http://www.ibm.com/de/support/ecurep/send_http.html
- **Standard upload with the system serial number:** http://www.ecurep.ibm.com/app/upload_hw
- **Secure upload:** http://www.ibm.com/de/support/ecurep/send_http.html#secure
- **Secure upload with the system serial number:** https://www.ecurep.ibm.com/app/upload_hw

Creating a personalized support web page

At http://www.ibm.com/support/mynotifications/, you can create a personalized support web page by identifying IBM products that are of interest to you. From this personalized page, you can subscribe to weekly email notifications about new technical documents, search for information and downloads, and access various administrative services.

Software service and support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems with your IBM products. For information about which products are supported by Support Line in your country or region, see http://www.ibm.com/services/supline/products/.

For more information about Support Line and other IBM services, see http://www.ibm.com/services/, or see http://www.ibm.com/planetwide/ for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

Hardware service and support

You can receive hardware service through your IBM reseller or IBM Services. To locate a reseller authorized by IBM to provide warranty service, go to http://www.ibm.com/partnerworld/ and click **Find Business Partners** on the right side of the page. For IBM support telephone numbers, see http://www.ibm.com/planetwide/. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

IBM Taiwan product service

台灣 IBM 產品服務聯絡方式：
台灣國際商業機器股份有限公司
台北市松仁路 7 號 3 樓
電話：0800-016-888

IBM Taiwan product service contact information:
IBM Taiwan Corporation
3F, No 7, Song Ren Rd.
Taipei, Taiwan
Telephone: 0800-016-888

Appendix B. Notices

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Important notes

Processor speed indicates the internal clock speed of the microprocessor; other factors also affect application performance.

CD or DVD drive speed is the variable read rate. Actual speeds vary and are often less than the possible maximum.

When referring to processor storage, real and virtual storage, or channel volume, KB stands for 1024 bytes, MB stands for 1,048,576 bytes, and GB stands for 1,073,741,824 bytes.

When referring to hard disk drive capacity or communications volume, MB stands for 1,000,000 bytes, and GB stands for 1,000,000,000 bytes. Total user-accessible capacity can vary depending on operating environments.

Maximum internal hard disk drive capacities assume the replacement of any standard hard disk drives and population of all hard disk drive bays with the largest currently supported drives that are available from IBM.

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Some software might differ from its retail version (if available) and might not include user manuals or all program functionality.

Particulate contamination

Attention: Airborne particulates (including metal flakes or particles) and reactive gases acting alone or in combination with other environmental factors such as humidity or temperature might pose a risk to the server that is described in this document. Risks that are posed by the presence of excessive particulate levels or concentrations of harmful gases include damage that might cause the server to malfunction or cease functioning altogether. This specification sets forth limits for particulates and gases that are intended to avoid such damage. The limits must not be viewed or used as definitive limits, because numerous other factors, such as temperature or moisture content of the air, can influence the impact of particulates or environmental corrosives and gaseous contaminant transfer. In the absence of specific limits that are set forth in this document, you must implement practices that maintain particulate and gas levels that are consistent with the protection of human health and safety. If IBM determines that the levels of particulates or gases in your environment have caused damage to the server, IBM may condition provision of repair or replacement of servers or parts on implementation of appropriate remedial measures to mitigate such environmental contamination. Implementation of such remedial measures is a customer responsibility.

Table 11. Limits for particulates and gases

Contaminant	Limits
Particulate	• The room air must be continuously filtered with 40% atmospheric dust spot efficiency (MERV 9) according to ASHRAE Standard 52.2[1]. • Air that enters a data center must be filtered to 99.97% efficiency or greater, using high-efficiency particulate air (HEPA) filters that meet MIL-STD-282. • The deliquescent relative humidity of the particulate contamination must be more than 60%[2]. • The room must be free of conductive contamination such as zinc whiskers.
Gaseous	• Copper: Class G1 as per ANSI/ISA 71.04-1985[3] • Silver: Corrosion rate of less than 300 Å in 30 days

[1] ASHRAE 52.2-2008 - *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*. Atlanta: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

[2] The deliquescent relative humidity of particulate contamination is the relative humidity at which the dust absorbs enough water to become wet and promote ionic conduction.

[3] ANSI/ISA-71.04-1985. *Environmental conditions for process measurement and control systems: Airborne contaminants*. Instrument Society of America, Research Triangle Park, North Carolina, U.S.A.

Documentation format

The publications for this product are in Adobe Portable Document Format (PDF) and should be compliant with accessibility standards. If you experience difficulties when you use the PDF files and want to request a web-based format or accessible PDF document for a publication, direct your mail to the following address:

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This product is not intended to be connected directly or indirectly by any means whatsoever to interfaces of public telecommunications networks, nor is it intended to be used in a public services network.

Electronic emission notices

When you attach a monitor to the equipment, you must use the designated monitor cable and any interference suppression devices that are supplied with the monitor.

Federal Communications Commission (FCC) statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. IBM is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

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Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

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Attention: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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Responsible manufacturer:
International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
914-499-1900

European Community contact:
IBM Deutschland GmbH
Technical Regulations, Department M372
IBM-Allee 1, 71139 Ehningen, Germany
Telephone: +49 7032 15 2941
Email: lugi@de.ibm.com

Germany Class A statement

Deutschsprachiger EU Hinweis:

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Technical Regulations, Abteilung M372
IBM-Allee 1, 71139 Ehningen, Germany
Telephone: +49 7032 15 2941
Email: lugi@de.ibm.com

Generelle Informationen:

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高調波ガイドライン適合品

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能會造成射頻干擾，在這
種情況下，使用者會被要
求採取某些適當的對策。

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